E-X-P-A-N-D-E-D EDITION

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H. G. CISIN'S

TUBE REPLACEMENT GUIDE

★ RADIO ★ TV ★ HI-FI

★ TV PIX TUBES

★ FOREIGN

H.G.CISIN'S
TUBE REPLACEMENT GUIDE

This expanded edition contains over 2700 substitutes for more than 1500 tubes. Substitutes are listed for radio and television receiving tubes, television picture tubes, for tubes used in Hi-Fi and stereo equipment and also for many of the foreign tubes now being imported.

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TUBE REPLACEMENT GUIDE

By H.G.Cisin, Consulting Engineer

The first section of the TUBE REPLACEMENT GUIDE contains a list of substitute receiving tubes suitable for use where identical replacement types are unavailable. All tubes suggested for substitution have characteristics similar to the tubes they are to replace, WILL FIT INTO THE SAME SOCKET, and DO NOT REQUIRE ANY CHANCES WHATSOEVER IN WIRING. In a number of instances, where no domestic substitute exists, foreign replacements obtainable in this country have been listed.

In most cases, it is preferable to replace with the original type, if this can be obtained. In certain instances, however, due to recent improvements in tube design, a substitute type tube will actually result in better performance. Substitutes listed below capable of equal or improved results have been underscored. Substitutes not underscored will in general function satisfactorily, although it is possible in a few isolated instances, that less than desired results may be obtained due to critical or unique circuit design. Suggested substitutes which are followed by the letter "t" in parenthesis, (t), are not recommended for permanent replacement. They have been listed merely to provide temporary operation until the original type or a recommended substitute can be obtained. Substitutes followed by the letter "f" in parenthesis, (f), are foreign tubes.

Certain tubes in the following lists may be substituted only in parallel connected circuits. These are indicated by an asterisk (*) after the tube designation. If no asterisk is shown, tube may be substituted in either series or parallel connected heater systems. In cases where the asterisk appears after a suggested substitute, it is necessary to know whether the heaters or filaments are connected in series or parallel. This information may be obtained readily without consulting a diagram or tracing the circuit. If a burn-out or defective tube is to be replaced, remove it from its socket. If all other tubes remain lit when the switch is turned on, the heaters are in parallel. If, upon removal of the defective tube, any other tubes show loss of heater glow, the removed tube is part of a series system hookup.

The second section of this book contains replacement substitutes for newer model television picture tubes. The third section includes substitutes for older model television picture tubes. Over 325 picture tube substitutes are listed. In most cases, picture tube substitutes are suggested which require no changes of any kind. In other cases, changes are clearly indicated but are slight, such as change in the type of ion trap or in the anode connector.

Section four contains U. S. A. substitutes for foreign tubes. Substitutes are suggested for over 225 foreign tubes. Section five contains a list of transistor substitutes, plus a table listing transistor replacements in a number of popular transistor radio receivers.

SECTION I

REPLACEMENT SUBSTITUTES for Radio, Television, Hi-Fi and Other Electronic Receiving Equipment

Tube	Substitute
00A	01A, 40
01A	00A, 00AA, 01B, 40
0A2	0B2, 6073, 150C2(f) STV150/30(f)
0A3	VR75, 0B3, 5651
0A4	1267, Z300T(f)
0B2	6074, STV108/30(f)
0B3	VR90, 1266
0C3	VR105
0D3	VR150, 150C3(f)
0E3	85A1(f)
0G3	STV85/10(f)
0Y4	0Y4G, 1005/CK1005, 0Z4A
0Z4	0Y4, 0Z4A, 1003, 1005/CK1005, 0Z4G
0Z4A	1003, 0Y4, 0Z4, 1005/CK1005
0Z4G	0Z4
1A3	DA90(f), 1D13(f)
1A4	1B4, 1A4P, 1A4T
1A5	1C5*, 1G4(t), 1Q5*
1A6	1C6*
1A7	1B7*, 1C7*, DK32(f), X14(f)
1AB6	1AC6*, DK96(f)
1AC5	1V5
1AC6	1AB6, DK92(f), X18(f)
1AD4	DF62(f)
1AD5	1AD4*, 1W5
1AE4	1L4*(t), 1T4*(t), 1U4*(t)
1AF4	1L4*, 1U4*, 1T4*(t), 1AJ4(t), DF96(f)
1AF5	1S5*, 1AH5
1AG5	1AJ5, 1AK5
1AH4	1AK4
1AH5	DAF96(f)
1AJ4	1AF4, DF96(f)
1AJ5	1AG5, 1AK5
1AK4	1AH4
1AK5	1AG5, 1AJ5
1AN5	DF97(f)
1AX2	1AX2A, 1AX2B, 1X2(t)
1B3	1G3, 1J3, 8016, 2B3(t), DY30(f)
1B4	1A4, 1E5, 32, 34
1B5	25S
1B7	1A7*, 1LC6
1B8	1D8
1C5	1A5*, 1Q5(t), DL35(f), N14 (f)
1C6	1A6
1C7	1D7*, KK32(f)
1C8	1AE5*, 1E8
1D5	1E5
1D7	1C7*
1D8	1B8
1E3	DC80(f)
1E4	1G4, 1H4(t)
1E5	KF35(f)
1E8	1C8
1F5	1J5, KL35(f)
1G3	1K3, 1B3
1G4	1E4, 1H4(t)
1G5	1J5, 1F5
1G6	1J6*(t)
1H4	1E4(t)
1H5	DAC32(f), HD14(f)
1J3	1B3

Tube	Substitute
1J5	1G5
1J6	1G6*
1K3	1G3
1L4	1AF4*, 1T4, 1U4, DF92(f)
1L6	1U6*
1LA4	1LB4
1LA6	1LC6
1LB4	1LA4
1LC5	1LG5, 1LN5
1LC6	1LA6
1LE3	1293*, 1LF3
1LF3	1LE3
1LG5	1LC5, 1LN5
1LN5	1LC5, 1LG5
1M3	DL70(f)
1N5	1P5, 1D5(t), DF33(f), Z14(f)
1P5	1N5
1Q5	1T5*, 1A6*, 1C5(t), DL36(f)
1R5	DK91(f), X17(f)
1S2	DY86(f), 1H2
1S2A	1H2
1S4	DL91(f)
1S5	1AF5*, DAF91(f), 1FD9(f)
1S6	1T6
1T4	1L4, 1AF4*, 1U4, DF91(f) 1F3(f)
1T5	1A5, 1C5*, 1G4(t), 1Q5
1T6	1S6
1U4	5910, 1AF4*, 1L4, 1T4, DF904(f)
1U5	DAF92(f)
1U6	1L6*
1V	6Z3
1V5	1AC5
1W5	1V5(t)
1X2	1AX2(t), 1AX2A, 1X2A, 1X2B
1X2A	1AX2, DY80(f), 1X2B
1X2B	1AX2, 1X2A
2A3	45, 5930
2A6	55*
2A7	2A7S
2AF4	2T4, 2AF4A, 2AF4B
2AF4A	2AF4, 2AF4B, 2T4
2AF4B	2AF4A, 2AF4, 2T4
2B3	1B3(t)
2B7	2B7S
2B7S	2B7
2C51	5670*, 6185, 6385, 6386
2C52	12SL7*, 12SN7(t), 12SX7(t)
2D21	2D21W, 5727
2D21W	2D21, 5727
2E5	2G5
2E30	5812
2E31	2E32
2E32	2E31
2E35	2E36
2E36	2E35
2E41	2E42
2E42	2E41
2G5	2E5
2G21	2G22
2G22	2G21
2T4	2AF4, 2AF4A, 2AF4B
3A3	3B2, 3C2
3A4	DL93(f)
3A5	DCC90(f)
3AU6	3BA6
3AV6	3BT6
3B2	3A3, 3C2
3B4	HD30(f)
3B5	3C5, 3Q5
3B7	1291
3BA6	3AU6
3BE6	3BY6(t)
3BT6	3AV6
3BY6	3CS6
3BZ6	3BC5, 3CB6
3C2	3A3, 3B2
3C4	3V4, DL96(f)
3C5	3B5, 3Q5
3CB6	3BC5, 3BZ6
3CE5	3CB6, 3CF6
3CF6	3BC5, 3BZ6, 3CB6, 3CE5
3CS6	3BY6

Tube	Substitute
3D6	3LF4*, 1299
3E5	3V4
3LE4	3LF4
3LF4	3LE4, 3D6*, 1299*
3Q4	3S4, DL95(f), N18(f)
3Q5	3B5, 3C5, DL33(f)
3S4	3Q4, DL92(f), N17(f), 1P10(f)
3V4	3C4*, 3E5*, DL94(f), N19(f)
4BC8	4BK7, 4BQ7, 4BQ7A, 4BS8, 4BZ7, 4BZ8
4BK7	4BC8, 4BQ7, 4BS8, 4BZ8
4BQ7	4BC8, 4BK7, 4BS8, 4BZ7, 4BZ8, 4BQ7A
4BS8	4BC8, 4BK7, 4BQ7, 4BQ7A, 4BZ8
4BX8	4BC8, 4BK7, 4BQ7, 4BS8, 4BZ8
4BZ7	4BC8, 4BK7, 4BQ7, 4BQ7A 4BS8, 4BZ8
4BZ8	4BC8, 4BK7, 4BQ7, 4BS8
4CB6	4BC5, 4DT6(t)
5AR4	GZ34(f)
5AS4	5AS4A, 5AW4, 5U4GA, 5U4GB 5V3, 5931
5AU4	5AW4, 5U4GA, 5U4GB, 5V3, 5931, 5AS4, 5R4GY, 5T4, 5U4G
5AW4	5U4, 5AU4, 5U4GA, 5U4GB, 5V3, 5931, 5AS4, 5R4GY, 5T4, 5U4G
5AX4	5AS4, 5U4GA, 5U4GB, 5X3, 5V4, 5931, 5T4, 5U4G, 5AZ4, 5U4, 5W4, 5Y3, 5Z4
5AZ4	5AX4, 5V4, 5Y3, 5U4, 5W4, 5Z4, 5AW4, 5T4
5BK7	5BQ7, 5BZ7
5CG4	5V4GA
5CL8	5CL8A
5R4GY	5AW4
5T4	5AS4, 5AW4, 5AX4, 5AZ4, 5R4, 5U4G, 5U4GA, 5U4GB, 5V4, 5W4, 5Y3, 5Z4, 5931
5U4G	5AS4, 5AW4, 5AX4, 5AZ4, 5T4, 5U4GA, 5U4GB, 5V3, 5W4, 5Y3, 5Z4, 5Y4, 5931, 5V3, U52(f), GZ34(f), H52(f)
5U4GA	5AS4, 5AW4, 5AU4, 5AX4, 5AZ4, 5T4, 5U4G, 5U4GB, 5V3, 5W4, 5Y3, 5Z4, 5Y4, 5931, H52(f), U52(f), G234(f)
5U4GB	5AS4, 5AU4, 5AW4, 5AX4, 5AZ4, 5T4, 5U4G, 5U4GA, 5V3, 5W4, 5Y3, 5Z4, 5Y4, 5931, U52(f)
5U8	5EA8
5V3	5AS4, 5AU4, 5AW4, 5U4GB
5V4	5AX4, 5AZ4, 5V4GA, 5T4, 5U4, 5W4, 5Y3, 5Z4, 5931, GZ32(f)
5W4	5AX4, 5AZ4, 5W4GT, 5T4, 5U4, 5V4, 5Y3, 5Z4, 5931
5X3	5Z3, 80, 83, 83V, 1275
5X4	5X4GA, 5Y4G, 5Y4GA, 5Y4GT
5Y3G	5Y3GT, 5Y3GA, 5AW4, 5AX4, 5AZ4, 5T4, 5V4, 5W4, 5Z4, 5931, 5U4G, 5U4GA, 5U4GB, U50(f), 608Z
5Y4	5X4, 5Z4, 5Y4GA, 5931
5Z3	5X3, 80, 83, 83V, 1275
5Z4	5V4, 5V4GA, 5931, 5AX4, 5AZ4, 5T4, 5U4, 5W4, 5Y3, GZ30(f)
6A4	52, LA
6A6	6E6*
6A7	6A7E(f), 6A7S
6A8	6D8*, 6J8, 6K8, X63(f) 6A8GT, 6A8G
6AB4	EC92 (f)
6AB5	6E5*(t), 6N5
6AB6	6AC6*
6AB7/1853	6AC7/1852, 6AJ7, 6SD7*, 6SE7*, 6SJ7*, 6SK7*, 6SS7*, 5693*
6AB8	ECL80(f), SN152(f)
6AC5G	6AC5GT
6AC5GT	6AC5G
6AC6	6AB6*

Tube	Substitution
6AC7	6AB7, 6AC7W, 6AJ7, 6SD7*, 6SJ7*, 6SK7*, 6SS7*, 1852, 1853, 6006*, 6134, 5693*
6AD5	6AE5, 6AF5, 6C5, 6J5, 6J5GT, 6J5WGT, 6P5
6AD6	6AF6
6AE5	6AD5, 6AF5, 6C5, 6J5, 6J5GT, 6J5WGT, 6P5
6AE8	X79
6AF4	6T4, 6AN4, 6AF4A
6AF5	6AD5, 6AE5, 6C5, 6J5, 6P5
6AF6	6AD6
6AG5	6AK5*, 6BC5, 6CF6, 5590*, 5591*, 9001*, 9003*, 6AJ5*(t), 6186, 6BA6, 6CE5, 6BD6, 6CB6, 6AH6, 6AS6(t), 6AS6W(t), 6BH6(t), 6BJ6(t), EF96(f)
6AG7	6AK7
6AH6	6BC5*, 6AJ5*(t), 6485, 6AK5*(t), 6AU6*(t), 6BD6*(t)
6AJ4	6AM4
6AJ5	6CF6*(t)
6AJ7	6AC7, 6AB7, 1852, 1853 6SD7*, 6SE7*, 6SJ7*, 6SK7*, 6SS7*, 5693*
6AJ8	ECH81(f), DP61(f)
6AK5	6AG5*, 6AJ5(t), 6CF6, 6BC5*(t), 5590*, 5591*, 9003, EF95(f), 5654
6AK7	6AG7
6AK8	6T8, 6T8A
6AL5	6AL5W, 5726, 6058, 6097, 6663, DZ77(f), DD6(f) EB91(f), EAA91(f), 6D2(f) D152(f), DD7(f)
6AM4	6AJ4
6AM5	EL91(f), NZ7(f), N144(f)
6AM6	6064, EF91(f), SP6(f), 8D3(f), Z77(f), 6F12(f)
6AM8	6AM8A
6AN4	6AF4, 6T4
6AN8	6AN8A
6AQ4	EC91 (f)
6AQ5	6BM5, 6AQ5A, 6AQ5W, 6005, 6669, EL90(f)
6AQ6	6AT6*, 6AV6*, 6BF6*, 6BK6,* 6BT6*, 6BU6*, 6066*
6AQ8	ECC85(f), B719(f)
6AR5	6098
6AS6	6AS6 W, 5725
6AS7	6080, 5998*
6AT6	6AV6, 6066, DH77(f), EBC90(f)
6AT8	6AT8A
6AU4	6AX4, 6BL4, 6W4, 6AU4GTA
6AU5	6AV5*, 6BD5*
6AU6	6BA6, 6BD6, 6AU6WA, 6AU6A, 6AU6WB, 6136, 5749, 6163, 5590*, 5591*, 9001*, 9003* 6AG5(t), 6AK5*(t), 6AK6*(t) 6AJ5*(t), EF94(f)
6AU8	6AW8, 6BA8, 6BH8
6AV4	6BX4, 6X4
6AV5	6AU5, 6BD5, 6AV5GA
6AV6	6AT6, 6AQ6*, 6066, 6BT6, EBC91(f)
6AW8	6AU8, 6AW8A
6AX4	6AU4, 6BL4, 6U4, 6W4, 6DA4
6AX5	6W5, 6X5, 6ZY5, 1274
6AX8	6AU8, 6U8*, 6U8A*
6B6	6Q7, 6Q7G, 6Q7GT
6B8	6B8G
6BA6	6AU6, 6BD6, 6AG5, 6BC5, 6CB6, 6CG6, 6BA6W, 5749, 6136, EF93(f), HM04(f), 6660
6BA8	6BA8A, 6AU8, 6AW8, 6BH8
6BC5	6CE5, 6CF6, 6AG5(t)*, 6AJ5*(t), 6AK5*(t), 9001*(t), 9003*(t), 5591*, 5654*
6BC8	6BQ7A, 6BS8, 6BQ7GB, 6BK7, 6BK7A, 6BK7B, 6BZ7, X155
6BD4	6BD4A, 6BK4
6BD4A	6BK4
6BD5	6AU5*(t) 6AV5*(t)
6BD6	6AH6*(t), 5749
6BE6	5915, EK90(f), 6BY6, 5750
6BE7	EQ80(f)

Tube	Substitution
6BE8	6BE8A
6BF5	6AQ5*(t), 6AQ5A*(t)
6BF6	6BU6
6BF7	6BG7
6BG6G	6CD6*(t), 6DN6, 6BG6GA
6BG7	6BF7
6BH6	6BJ6, 6AS6*, 6BC5*(t), 6CB6*, 6265, 6661,
6BH8	6AU8, 6AW8, 6BA8
6BJ5	N78(f)
6BJ6	6BH6, 6BA6*, 6AS6*, 6BC5*(t), 6CB6*, 6BA6W, 5749, 6136, 6662
6BJ8	6BN8
6BK7A	6BK7B
6BK4	6BD4A
6BK6	6066, 6AT6, 6AV6, 6BF6, 6BT6, 6BU6
6BK7	6BK7B, 6BQ7, 6BQ7A, 6BS8, 6BZ7, 6BZ8, X155, 6BC8
6BK7A	6BK7B, 6BQ7, 6BQ7A, 6BS8, 6BZ7, 6BZ8, X155, 6BC8
6BL4	6AU4GTA, 6AX4(t)
6BL7GT	6BX7, 6SN7*, 6SU7*(t), 5592, 5591*(t), 6SL7(t), 6BL7GTA
6BM5	6A05
6BM8	ECL82(f)
6BN5	EL85(f)
6BN8	6BJ8
6BQ5	EL84(f), N709(f)
6BQ6G	6BQ6GT, 6BQ6GTA, 6BQ6GTB, 6CU6, 6DQ6, 6DQ6A
6BQ7	6BC8, 6BK7, 6BK7A, 6B07A, 6BZ7, 6BZ8, X155
6BR5	EM80(f)
6BR8	6CL8A, 6BR8A
6BS8	6BC8, 6BK7, 6BK7A, 6BQ7, 6BQ7A, 6BZ8, X155
6BT6	6066, 6BK6, 6AQ6*, 6BD7*, 6AV6
6BU6	6BF6
6BW4	EZ81*(f), 6CA4
6BW7	6BX6
6BX4	6X4, 6AV4*
6BX6	6BN7, 6BY7, EF80(f), Z152(f), Z179(f)
6BX7	6BL7
6BX8	6BC8, 6BE6, 6BK7, 6BQ7, 6BS8, 6BZ7, 6BZ8, X155
6BY6	6CS6, 5915
6BY7	6BX6, EF85(f), W179(f)
6BZ6	6CB6, 6DE6
6BZ7	6BQ7A, 6BQ7, 6BK7A, 6BK7, 6BC8, 6B08, 6BS8, 6BZ8, X155
6BZ8	6BC8, 6BK7A, 6BK7, 6BS8, 6BZ7, 6BQ7A, 6BQ7, 6BQ8, X155
6C4	5610, 6135, 9002(t), EC90(f), LZ7(f), 6100
6C5	6AD5, 6AE5, 6AF5, 6L5*
6C6	6D6, Z7, Z8, 1221, 1603, Z700
6C8	6F8*
6CA4	EZ81*(f), 6BW4*
6CA7	6L6*, EL34(f), 6L6GB*, 6L6GC*, KT66*, 5881*, 7027*, 6L6G, 6L6GA
6CB5	6CB5A
6CB6	6DE6, 6CB6A, 6BZ6, 6DC6, 6AS6*(t), 6BH6*(t), 6BJ6*(t), 6CF6, 6AG5, 6BC5, 6AJ5*, 6AK5*, 5590*, 5591*, 5654*
6CD6G	6DN6, 6BG6*, 6CD6-GA,
6CD7	EM34(f)
6CF6	6CB6, 6AG5, 6AK5, 6BC5, 5590, 5591, 5654, 9001(t), 9003(t), 6AJ5*(t), 6186
6CG6	6AG5, 6AU6, 6BA6, 6BC5, 6BD6, 6AH6*, 6AK5*, 5591*, 5654*, 5590*(t), 9001*(t), 9003*(t), 6AJ5*(t)
6CG8	6CG8A
6CH6	6132, EL821(f)
6CJ6	EL81(f)
6CK6	EL83(f)
6CL6	6677

Tube	Substitute
6CL8	6CL8A
6CN6	EL38(f)
6CS6	6BY6, 6BE6, EH90(f)
6CU6	6DQ6G, 6BQ6GT, 6DQ6A, 6BQ6GTA, 6BQ6GTB, 6DQ6, 6DQ6A
6D6	6C6, 77, Z8
6D7	6E7
6D8	6A8*, 6J8*, 6K8*
6DC6	6BZ6, 6CB6, 6DE6
6DE6	6BZ6, 6CB6, 6DC6
6DG6	6W6, 6K6*, 6V6*
6DN6	6CD6, 6BG6, 6BG6GA
6DQ6	6BQ6GT, 6BQ6GTA, 6CU6, 6DQ6A
6E5	6T5, 6U5, 6G5
6E6	6A6
6E7	6D7
6E8	ECH35(f)
6F4	6L4(t)
6F5	H63(f), 6F5GT
6F6	6K6*, 6L6*, 6U6*, 6V6*, 6G6*(t), 1611, 5881*, 1621, 1622*, KT63(f), 6F6G, 6F6GT
6F7	6F7S
6F8	6C8*
6G5	6E5, 6T5, 6U5, 6AB5*
6G6	6F6, 6K6, 6V6
6H5	6U5, 6G5
6H6	EB34(f), D63(f), 6H6GT
6J4	6J4WA
6J5	6AD5, 6AE5, 6AF5, 6C5, 6L5*, 6P5, 6J5GT, 6J5 WGT, L63(f)
6J6	5964, 6101, 6J6A
6J7	6J7GT, 6K7, 6S7*, 6U7, 6W7* 6J7G, 7000, 1223, 1620
6J8	6A8, 6D8*, 6K8
6K4	6AD4
6K6	6F6*, 6L6*, 6U6*, 6V6*, 6G6(t)*, 1621*, 5871
6K7	6J7, 6S7*, 6U7, 6W7*, 5732, 6K7G, 6K7GT

Tube	Substitute
6K8	6A8, 6J7
6L4	6F4(t)
6L5	6AD5*, 6AE5*, 6C5*
6L6	6F6*, 6K6*, 6U6*, 6V6*, 1614, KT66*(f), 5881, 1621*, 1622, 5932, 6550, 7027*, 6L6G, 6L6GB, 6L6GC
6L7	1612, 6L7G
6N6	6AB6*
6N7	6Y7, 6Z7, 1635*, 6N7GT
6N8	EBF80(f)
6P5	6AD5, 6AE5, 6AF5, 6C5, 6J5, 6L5*
6P8G	ECH35*
6Q4	EC80
6Q5	884
6Q7	6B6, 6R7, 6T7*, 6V7, DH63(f)
6R4	EC81(f)
6R7	6Q7, 6T7*, 6V7
6R8	6T8, 6AK8, 6T8A
6S4	6S4A
6S7	5732*, 6W7, 6J7*, 6K7*, 6U7*
6SA7	5961, 6SB7Y
6SB7Y	6SA7, 5961
6SD7	6AB7*, 6AC7*, 6SS7*, 6SE7, 6SJ7, 6SK7, 5693, 1852*, 1853*
6SE7	6AB7*, 6AC7*, 6SS7*, 6SD7, 6SJ7, 6SK7, 5693, 1852*, 1853*
6SF7	6SV7
6SG7	6AB7*, 6AC7*, 6006, 6SG7GT
6SH7	6AB7*, 6AC7*, 6SG7, 6SG7GT, 6SJ7, 6SK7, 6SH7GT
6SJ7	5693, 6SK7, 6SS7*, 6SJ7WGT, 6006, 6SJ7GT
6SK7	6AB7*, 6AC7*, 6SG7, 6SH7, 6SJ7, 6SS7*, 6137, 6006
6SL7	6SL7WGT, 6113, 6SN7*, 6SU7, 5691*, 5692(t), 6SL7GT, 6SU7GTY
6SN7	6BL7*, 6BX7*, 6SL7*, 6SL7GT*, 6SN7GT, (Cont'd)

Tube	Substitute
6SN7	(Cont'd) 6SN7WGT, 6SN7GTA, 6SN7GTB, 5692, 6180, 5691(t), B65(f), ECC33*(f)
6SQ7	6SR7, 6ST7*, 6SZ7*, 6SQ7G
6SR7	6SQ7, 6SZ7*, 6ST7*, 6SR7GT
6SS7	6SJ7*, 6SK7*, 6SS7GT
6ST7	6SQ7*, 6SR7*
6SU7	6SL7, 6SN7(t), 6113
6SV7	6SF7
6SZ7	6SQ7*, 6SR7*, 6ST7
6T4	6AN4, 6AF4
6T5	6AB5*, 6E5, 6U5, 6G5, 6N5
6T7	6B6*, 6Q7*, 6R7*, 6V7*
6T8	6R8, 6AK8, EABC80(f) 6T8A
6U3	EY80(f)
6U4GT	6AX4GT, 6DA4, 6W4
6U5	6G5, 6AB5*, 6E5*, 6N5*, Y61(f)
6U6	6F6*, 6G6*(t), 6K6*, 6L6*(t), 6V6*, 6W6*(t), 5881*
6U7	6K7, 5732, 6J7
6U8	6AX8, 6U8A, ECF82(f)
6V3	6V3A
6V4	EZ80(f)
6V6	6F6*, 6G6*(t), 6K6, 6L6*, 6U6*, 6W6*, 6Y6*, 1621*, 1622*, 5871, 5992, 6V6GTA, 6V6GT
6V7	6R7, 6T7*
6W2	6X2
6W4	6AX4, 6U4, 6DA4
6W5	6AX5*, 6X5*, 6ZY5*
6W6	6G6*, 6L6*, 5881* 6F6*(t), 6K6*, 6U6* 6V6*, 6Y6G, 6Y6GA, 6Y6GT
6W7	6J7*, 6K7*, 6U7*, 6S7
6X2	6W2, EY51(f)
6X4	6X4W, 6BX4, 6AV4*, 6063, 6202, EZ90(f), U78(f)
6X5	6AX5*, 6W5*, 6ZY5*, 1274*, (Cont'd)

Tube	Substitute
6X5	(Cont'd) 6X5WGT, EZ35(f), U147(f), U70(f), 6X5GT
6X8	6X8A
6Y5	6Z5 (6-volt use only)
6Y6	6K6*, 6L6*, 6U6*, 6V6*, 6G6*(t), 6Y6G, 6Y6GA, 6Y6GT
6Y7	6N7*, 6Z7*, 1635
6Z3	1V
6Z5	6Y5 (6-volt use only)
6Z7	6N7*, 6Y7*
6ZY5	6AX5*, 6W5*, 6X5*, 1274
7A4	7B4, XXL
7A5	7B5*, 7C5*
7A7	7H7, 7L7, 7B7*, 7C7*
7A8	7B8*, 7J8*, 7S7*
7AB7	1204
7AD7	7AG7*(t), 7AH7*(t), 7AJ7*(t), 7AK7*(t), 7B7*(t) 7C7*(t), 7G7*(t) 7H7*(t) 7L7*(t), 7T7*(t), 7V7*(t)
7AF7	7F7, 7N7*
7AG7	7AH7, 7B7(t), 7C7(t), 7AJ7*(t), 7AK7*(t), 7G7*, 7H7*, 7L7*, 7T7*, 7V7*
7AH7	7AG7, 7B7(t), 7C7(t), 7AJ7*, 7AK7*(t), 7G7*(t), 7H7*(t), 7L7*(t), 7T7*(t), 7V7*(t)
7AJ7	7AH7*, 7AK7*(t), 7B7*(t), 7C7*(t), 7G7*(t), 7V7*(t), 7H7, 7L7, 7T7
7AK7	7AH7*(t), 7AJ7*(t), 7B7*(t), 7C7*(t), 7G7*(t), 7H7*(t), 7L7*(t), 7T7*(t), 7V7*(t)
7AN7	PCC84(f), B319(f), 30L1(f)
7B4	7A4, XXL
7B5	7A5*, 7C5*
7B6	7E6
7B7	7AH7, 7C7, 7H7*, W149(f)
7B8	7A8*, 7J7, 7S7
7C4	1203A
7C5	7A5*, 7B5*
7C6	7B6*, DH149(f)
7C7	7B7, 7H7
7E5	1201

Tube	Substitute
7F7	7AF7, 7N7*
7F8	7F8W
7G7	7A7*, 7B7*, 7C7*, 7H7*, 7L7*, 7V7, 1232*
7G8	1206
7H7	7A7, 7B7*, 7C7*, 7L7, 7T7, 7V7*, 1273
7J7	7B8,7S7
7L7	7A7, 7G7*, 7H7, 7T7, 7V7*
7N7	7AF7*, 7F7*
7R7	7E7
7S7	7B8, 7J7, X81(f), X148(f)
7T7	7A7, 7B7*, 7C7*, 7G7*, 7H7, 7L7, 7V7, 1231*, 1273
7V7	7B7*, 7C7*, 7G7, 1232
7X7	XXFM
7Y4	7Z4*
7Z4	7Y4
8A8	LZ319(f), PCF80(f), 30C1(f)
8AU8	8AW8, 8BA8, 8BH8, 8AU8A
8AW8	8AU8, 8BH8
8BA8	8AU8, 8AW8
8BH8	8AU8, 8AW8
9A8	PCF80(f)
9AK8	PABC80(f)
9AQ8	PCC85(f)
9U8	PCF82(f), 9U8A
10	10Y, RK10, 50, 210, 310,
10Y	10, RK10, 50, 210, 310
12A	71A
12A4	12B4
12A8	12K8
12AC5	UF41(f)
12AC6	12AF6
12AD6	12AG6
12AD7	12AX7*
12AE6	12AT6, 12AV6
12AF6	12AC6
12AG6	12AD6

Tube	Substitute
12AK7	12AZ7*, 12AXZ, 12AY7, 12AD7
12AT6	12AV6, 12BK6, 12BF6(t), 12BT6(t), 12BU6(t), HBC90(f)
12AT7	12AT7WA, 6060, 6201, 6679, 12AU7, 12AV7*, 12AX7, 12AY7, 12AZ7*, ECC81(f), B309(f), B152(f)
12AU6	12BA6, 12BD6, B329(f), ECC82(f), HF94(f)
12AU7	12AU7WA, 5814, 5814A, 6067, 6189, 6680, 5963, 12AZ7*(t), 12AU7A, 12AT7, 12AX7, 12AY7, 12AV7*
12AV6	12AT6, 12BK6, 12BT6, 12BU6, 12BF6(t), HBC91(f)
12AV7	5965, 12AZ7, 12AT7*, 12AU7*, 12AX7*, 12AY7*, 12BH7*
12AX4GT	12AX4GTA
12AX7	12AT7, 12AU7, 12AY7, 12AV7*, 12BH7*, 12AZ7*, 12AD7, 5751, 6057, 6681, ECC83(f)
12AY7	12AT7, 12AU7, 12AV7*, 12AX7, 12BH7*, 6072
12AZ7	12AT7, 12BH7, 12AU7(t), 12AX7(t), 12AY7(t), 12AV7
12B4	12A4, 12B4A
12B7	14AZ
12BA6	12AU6, 12BD6, HF93(f)
12BD6	12AU6, 12BA6
12BE6	HK90(f)
12BF6	12BU6, 12AT6(t), 12AV6(t), 12BK6, 12BT6
12BH7	12AT7*, 12AU7*, 12BH7A, 12AV7*, 12AX7*, 12AY7*, 12AZ7*
12BK6	12BU6, 12BT6, 12AT6, 12AV6, 12BF6(t)
12BQ6	12BQ6GA, 12BQ6GTA, 12BQ6GTB, 12CU6, 12DQ6, 12CH6
12BT6	12AT6, 12AV6, 12BK6, 12BU6, 12BF6(t)
12BU6	12BF6, 12AT6(t), 12AV6(t), 12BK6(t), 12BT6(t)

Tube	Substitute
12BV7	12BYZ, 12BYZA
12BY7	12BYZA, 12BYZ
12BZ7	12AX7*
12C5	12CA5, 12CU5
12CA5	12C5
12CU5	12C5
12CU6	12BQ6, 12DQ6
12D4	12AX4, 12AX4GTA
12DQ6	12BQ6, 12BQ6GA, 12BQ6GTA, 12BQ6GTB, 12CU6, 12CH6
12DT7	7025
12E5	1626*, 12J5, 12J5GT, 12J5WGT
12J5	1626*, 12E5, 12J5GT, 12J5WGT
12J7	12K7
12K7	12J7
12K8	12A8
12L6	12W6, 1632
12L8	1644
12SA7	12SY7
12SC7	1634
12SG7	12SH7, 12SJ7, 12SK7
12SH7	12SG7, 12SJ7, 12SK7
12SJ7GT	12SJ7
12SK7	12SG7, 12SH7, 12SJ7, 12SK7GT
12SL7	2C52*
12SN7	12SX7, 12SL7*(t), 12X7, 12SN7GT, 12SN7GTA, B36(f)
12SQ7	12SR7, 12SW7(t)
12SR7	12SQ7, 12SW7, 12SR7GT,
12SW7	12SQ7(t), 12SR7
12SX7	12SN7, 12SL7*(t)
12SY7	12SA7
12W6	12L6, 1632
14A7/12BH7	1280, 1284, 14C7, 14H7
14AF7/XXD	14F7, 14N7*
14B6	14E6
14B8	14J7, 14S7
14C5	14A5*
14C7	14B7, 1284, 14A7, 14H7, 1280
14E6	14B6
14E7	14R7
14F7	14R7, 14AF7/XXD
14H7	14A7, 14C7, 1280, 1284
14J7	14B8, 14S7
14K7	UCH42(f)
14L7	UBC41(f)
14N7	14AF7/XX2*
14R7	14E7
14S7	14B8, 14J7
14W7	12B7, 14A7, 14C7, 14H7, 1280, 1284
15A6	PL83(f)
16A5	PL82(f), N329(f)
17DQ6	17DQ6GA, 17DQ6A
17Z3	PY81(f)
19AQ5	HL90(f)
19AU4	19AU4GTA
19BG6	19BG6G, 19BG6GA
19C8	19T8
19T8	19C8
19X3	19Y3
19Y3	19X3, U154(f), PY82(f), U319(f)
20	X99*(f)
21A6	PL81(f), N152(f), N359(f)
24A	35/51(t)
25A6	25B6, 25C6, 25L6, 5824
25A7	32L7
25AV5GT	25AV5GA
25AX4	25U4, 25W4
25B5	43
25B6	25A6, 25G6, 25L6, 25N6, 5824
25BQ6	25BQ6GT, 25BQ6GA, 25BQ6GTB, 25CU6, 25DQ6
25BQ6GA	25BQ6GTB, 25CU6, 25DQ6
25BQ6GT	25BQ6GA, 25BQ6GTB, (Cont'd.)

Tube	Substitute
25BQ6GT	- (Cont'd) 25CU6, 25DQ6
25C5	- 25CA5
25C6	- 25A6, 25B6, 25L6, 25N6, 5824
25CA5	- 25C5
25CD6	- 25DN6
25CU6	- 25BQ6, 25DQ6, 25BQ6G, 25BQ6GA 25BQ6GT, 25BQ6GTB
25DN6	- 25CD6
25DQ6	- 25BQ6, 25BQ6G, 25BQ6GT, 25BQ6GTB, 25CU6, 25BQ6GA
25L6	- 6046, 25A6, 25B6, 25C6, 25N6, 5824, KT32(f)
25S	- 1B5
25U4	- 25AX4, 25W4
25W4	- 25U4, 25AX4
25Y5	- 26Z5
25Z5	- 25Y5
25Z6	- 25Z6GT, 25Z6WGT, 35Z6(t)
26A6	- 26CG6
26BK6	- 26C6(t)
26C6	- 26BK6(t)
26CG6	- 26A6
27	- 56
28D7	- 28D7W, 1238
28D7W	- 28DZ, 1238
30	- 31*
31	- 30*
32	- 1A4, 1B4, 951
32L7	- 25A7
33	- 1F4*, 950*
34	- 1A4, 1B4, 32, 951
35/51	- 24A
35A5	- 50A5 (series fil.)
35B5	- 50B5 (series fil.)
35Z6	- 50Z6 (series fil.)
35L6	- 50C6, 50L6
35Z5	- 45Z5 (series fil.)
36	- 39/44
37	- 76

Tube	Substitute
39/44	- 36
40	- 00A, 01A, 12A
40A1	- 40B2
40B2	- 40A1
41	- 42
42	- 6B5, 41
45	- 2A3
45Z5	- 35Z5 (series fil.)
50	- 10
50AX6	- 50Z6
50C5	- HL92(f)
50C6	- 50L6
50L6	- 50C6
50Y7	- 50Z7
50Z6	- 50AX6
50Z7	- 50Y7
53	- 5608-A
55	- 2A6
55S	- 2A6, 55
56	- 27, 485
56AS	- 37*, 76*
56S	- 27, 56
57	- 58
57AS	- 6C6*, 77*
57S	- 57, 58
58	- 57(t)
58AS	- 6D6*, 78*
58S	- 57, 58
71A	- 482, 483
75	- 6C6(t), 85(t)
76	- 37
77	- 6C6, 1221
78	- 6D6
80	- 83V, 83, 5Z3
81	- 10(t), 50(t)
82	- 2A3(t), 45(t)
83	- 5Z3
83V	- 5Z3, 80, 83
85	- 75
85AS	- 85
89	- 89Y
117L7GT	- 117L7/M7GT

Tube	Substitution
117L7/M7GT	- 117L7GT
117N7GT	- 117P7GT
117P7GT	- 117N7GT
182B/482B	- Z1A, 183/483
183/483	- Z1A, 182B/482B
807	- 5933, QV05-25(f), 807W
807W	- 5933, 807, QV05-25(f)
884	- 6Q5
950	- 1F4, 33*
954	- 956
955	- 5731(t)
956	- 954
957	- 958A*
958A	- 957*
1005/CK1005	- 0Y4, 0Z4A
1201	- 7E5
1203	- 7C4
1204	- 7AB7
1206	- 7G8
1221	- 6C6, 77
1223	- 6J7
1229	- 1A4, 1B4, 32, 951
1230	- 30
1231	- 7G7, 7V7
1232	- 7G7
1238	- 28D7
1266	- 0B3
1267	- 0A4
1273	- 7A7, 7AJ7, 7H7, 7L7, 7T7
1274	- 6AX5*, 6W5*, 6ZY5*, 6X5
1275	- 5Z3, 5X3, 80, 83, 83V
1280	- 12B7, 1284
1284	- 12B7, 1280
1291	- 3B7
1293	- 1LE3*
1294	- 1R4
1299	- 3D6
1612	- 6L7
1614	- 6L6, 5881
1620	- 6J7
1621	- 6F6, 5881*, 6K6*, 6L6*, 6V6*
1622	- 6L6, 6F6*, 6V6*, 5881
1626	- 12E5*, 12J5*
1632	- 12L6, 12W6
1634	- 12SC7
1635	- 6Y7, 6N7*
1639	- EBC33(f)
1644	- 12L8
2050	- 2051
2051	- 2050
5517	- CK1013
5590	- 6BC5*, 5591, 9001, 9003, 6AG5*(t)
5591	- 5590, 9001, 9003, 6AG5*, 6BC5*(t), 6AK5, 5654, 6CF6*
5608A	- 53
5610	- 6C4
5633	- 5634
5634	- 5633
5641	- EY70(f)
5651	- 0A3
5654	- 6AJ5, 6AK5, 6096, 5591
5670	- 5670WA, 2C51
5670WA	- 5670, 2C51
5672	- 5678
5676	- 5677*
5677	- 5676*
5678	- 5672
5691	- 6SL7*, 6SN7(t)
5692	- 6SN7, 6180
5693	- 6SJ7
5702	- 5784
5718	- EC70(f)
5725	- 6AS6W, 6AS6, 6187
5726	- 6AL5W, 6AL5, 6058, 6097
5727	- 2D21W, 2D21
5732	- 6K7
5749	- 6BA6W, 6BA6
5750	- 6BE6, 6BE6W
5751	- 5751WA, 12AX7, 6057
5751WA	- 12AX7, 6057, 5751
5812	- 2E30
5814	- 12AU7, 5814WA, 12AU7A

Tube	Substitute
5814A-	12AU7, 5814, 5814WA, 12AU7A
5824 -	25B6, 25L6
5838 -	5839*
5839 -	5838*
5840 -	5899, 5900, 5901
5861 -	TD03-10 (f)
5871 -	6V6, 5992
5881 -	1622, 5932, 1621*, 6K6(t), 6F6(t), 6U6(t), 6V6(t)
5899 -	5840, 5900, 5901
5900 -	5840, 5899, 5901
5901 -	5840, 5899, 5900
5910 -	1U4
5915 -	6BY6, 6BE6
5930 -	2A3
5931 -	5U4GB
5932 -	6L6, 5881
5933 -	807
5961 -	6SA7
5963 -	12AU7
5964 -	6J6
5965 -	12AV7, 6829
5992 -	6V6, 5871*
5998 -	6AS7*
6005 -	6AQ5W, 6AQ5, 6095
6006 -	6SG7
6046 -	25L6, 5824
6057 -	12AX7, 5751
6058 -	6AL5, 5726
6060 -	12AT7, 6201
6063 -	6X4
6064 -	6AM6
6066 -	6AT6
6067 -	5814*, 12AU7
6072 -	12AY7
6073 -	0A2
6074 -	0B2
6080 -	6AS7
6087 -	5Y3GT
6095 -	6AQ5W, 6AQ5, 6005
6096 -	6AK5, 5654
6097 -	6AL5, 5726
6100 -	6C4
6101 -	6J6
6113 -	6SL7
6132 -	6CH6
6134 -	6AC7
6135 -	6C5
6136 -	6AU6, 6AU6WA, 6AU6WB
6137 -	6SK7
6180 -	5692, 6SN7
6186 -	6AG5
6187 -	6AS6W, 6AS6, 5725
6189 -	12AU7WA, 12AU7
6201 -	12AT7, 6060
6202 -	6X4
6252 -	QQV03-28(f)
6265 -	6BH6
6267 -	EF86(f)
6360 -	QQV03-10(f)
6373 -	EL70(f)
6374 -	EY84(f)
6375 -	DC70(f)
6485 -	6AH6
6487 -	EF70(f)
6488 -	EF73(f)
6489 -	EA76(f)
6550 -	6L6
6661 -	6BH6
6662 -	6BJ6
6663 -	6AL5
6669 -	6AQ5
6677 -	6CL6
6679 -	12AT7
6680 -	12AU7
6681 -	12AX7
6688 -	E180F(f)
6779 -	Z803U(f)
6829 -	5965
6922 -	E88CC(f)
7000 -	6JZ
7700 -	6C6, 1603
8016 -	1B3

Tube	Substitute	Tube	Substitute
9001 -	5590, 5591, 9003(t)	X155 -	6BZ8, 6BC8, 6BK7, 6B07, 6BS8, 6BZ7
9003 -	5590, 9001		
CK1013 -	5517	XXFM -	7XZ
VT52 -	10*(t), 50*(t)	XXL -	7A4
X99 -	20*		

Every effort has been made to make this replacement guide complete and accurate. Nevertheless, there is always the possibility of a few errors of omission or commission. For this reason, the publisher assumes no responsibility in connection with substitutions made in accordance with this guide.

If the tube for which a substitute is desired, is not listed, this is probably because a change in socket or wiring would be necessary in order to use a different type tube or because no suitable substitute can be obtained.

Where a tube is to be substituted in a modern series string circuit, it is important to use only that type which has controlled warm-up time. Use of a tube lacking this feature may result in premature failure. For example a 6SN7GTA tube must not be substituted in a series string circuit for a 6SN7GTB, since the former lacks the controlled warm-up feature.

SECTION 2

TV PICTURE TUBE REPLACEMENT GUIDE
Newer Models

How to Select Picture Tubes Suitable for Substitution

1. Use Index "A" to find tube to be replaced. If not found in this index, it may be listed below in the index of older tubes, Index "B".

2. Refer to the Code Letter in Index "A", which appears at the right of the tube type to be replaced. This is the Code Letter of the Replacement Group.

3. Next, refer to this Code Letter in the Replacement Group Table. All tubes having the same Group Code Letter have identical basing connections. These groups have also been arranged so that round tubes are grouped only with other round tubes and rectangular tubes are found only in the same groups as other rectangular tubes. Tubes of similar deflection angles are grouped together. Tubes of similar maximum anode voltage ratings are also grouped together. It is undesirable to substitute a tube of lower maximum voltage rating in the place of one having a higher maximum anode voltage rating.

No effort has been made to segregate tubes having external conductive coating from those without such coating. When a tube with external conductive coating is used to replace one without such coating, the external coating must be grounded to the chassis. When a tube without external coating is used to replace one with this coating, it is necessary to connect a suitable special high-voltage condenser between the anode connection and the chassis. Required condenser values range from 400 MMF minimum to 3000 MMF maximum. Best values may be determined by trial. Suggested minimum and maximum values in MMF are given in the last column of the Table of Replacement Groups. The condenser is generally installed close to the high voltage rectifier.

4. Having located the particular GROUP you must use, in the REPLACEMENT GROUP TABLE, the next step is to select as your first choice a picture tube which most closely fits the specifications of the original tube as to deflection angle, maximum anode voltage, type of ion trap, method of focus and dimensions.

Some of the picture tubes listed use a single field ion trap; others require a double field ion trap. Still others need no ion trap. Various types will be found in the same group, since it is a simple matter to dispense with the ion trap if not required with the substitute tube, or to substitute a single magnet ion trap for a double magnet one, or vice versa. If a different ion trap is specified for the substitute tube, this should be installed.

Single field ion traps are coded "S" in the Replacement Group Table. Double field ion traps are coded "D". If no ion trap is required, code letter "N" is used.

5. If the tube selected cannot be obtained, make a second selection from the same group. In this case it may be necessary to select a tube having a different type of ion trap or possibly one using a different method of focusing. Methods of focusing include High Voltage Electrostatic focusing, Low-Voltage Electrostatic focusing, Automatic Electrostatic focusing (self-focusing) and Magnetic focusing.

Following coding is used in the Focus Column of the Replacement Tube Table:

High Electrostatic Focusing -- HE
Low Electrostatic Focusing -- LE
Automatic ---------- A
Magnetic Focusing ---------- M

When substituting a self-focusing tube for a magnetically focused tube, remove the focus coil from the tube neck and mount it in the cabinet as far from the new tube as possible. It will usually be necessary to install a magnetic centering device. The focus coil should not be disconnected from the circuit unless it is replaced by an equivalent inductance or focus resistance.

When substituting an automatic electrostatic focus tube for an electrostatic focus tube, no change in socket wiring is necessary and it is unnecessary to remove the focus electrode lead from the socket.

To avoid the necessity of wiring changes, magnetic focus tubes have not been grouped with electrostatic focus tubes. When replacing a high voltage electrostatic focus tube with a low voltage electrostatic focus tube or an automatic focus tube, it is best to remove the focus rectifier.

6. If a substitute tube is selected which has a different nominal length, make sure that the new tube will fit into the space formerly occupied by the original tube. If the curvature of the face plate is different, a new mask may be required. Although the recessed small cavity cap is the most common type of anode connector, other types such as metal-shell lip, cone, etc. may be encountered, in which case the necessary change can be made without difficulty. Differences in face plates, such as gray filter glass, clear glass, tinted glass, frosted glass, etc. do not affect interchangeability, hence picture tubes with such differences may be found in the same groups.

Typical Example

Let us assume that it is desired to find a substitute picture tube for a 17BRP4 tube. Referring to the Index "A" we find that this belongs in the "S" Group. Next, referring to the Table of Replacement Groups, it is immediately apparent that the closest replacement is the 17CKP4. However, any of the other tubes listed in the "S" group may be substituted for the 17BRP4 even though the maximum anode voltage rating of these other tubes is 17.6 KV, since these tubes will operate well at 14 KV, which is a typical operating voltage for the 17BRP4. If any of these other tubes is substituted, ion trap must not be used.

INDEX A

Pix Tube Type -- Replacement Group Code Letter

9QP4	-- A	14QP4 A	-- K	17CWP4	-- S	21DLP4	-- W
9QP4A	-- A	14RP4	-- L	17CXP4	-- U	21DMP4	-- X
10ABP4	-- B	14RP4A	-- L	17CYP4	-- U	21DNP4	-- W
10ABP4A	-- B	14SP4	-- L	17CZP4	-- U	21DQP4	-- W
10ABP4B	-- B	14WP4	-- L	17DCP4	-- U	21DRP4	-- W
10ABP4C	-- B	14ZP4	-- L	17DJP4	-- U	21DSP4	-- W
10ADP4	-- B	15CP4	-- M	21ACP4	-- V	21DVP4	-- W
10AEP4	-- B	15DP4	-- M	21ACP4A	-- V	21DWP4	-- X
10BP4	-- C	15DP4A	-- M	21ALP4	-- W	21ELP4	-- W
10BP4A	-- C	16KP4	-- N	21ALP4A	-- W	21EMP4	-- X
10BP4C	-- C	16KP4A	-- N	21ALP4B	-- W	21ENP4	-- W
10BP4D	-- C	16RP4	-- N	21AMP4	-- V	21EQP4	-- Z
10FP4	-- C	16RP4A	-- N	21AMP4A	-- V	21ERP4	-- Z
10FP4A	-- C	16SP4	-- O	21ATP4	-- W	24ADP4	-- AA
12LP4	-- D	16SP4A	-- O	21ATP4A	-- W	24AEP4	-- AB
12LP4A	-- D	16YP4	-- O	21BAP4	-- W	24AHP4	-- AC
12LP4C	-- D	17ATP4	-- P	21BNP4	-- W	24AJP4	-- AB
12QP4	-- E	17ATP4A	-- P	21BSP4	-- V	24ALP4	-- AC
12QP4A	-- E	17AVP4	-- P	21BTP4	-- W	24ANP4	-- AB
12RP4	-- E	17AVP4A	-- P	21CBP4	-- W	24AQP4	-- AC
12TP4	-- E	17BP4	-- R	21CBP4A	-- W	24ASP4	-- AB
12UP4	-- E	17BJP4	-- P	21CBP4B	-- W	24ATP4	-- AB
12UP4A	-- E	17BKP4	-- P	21CDP4	-- W	24AUP4	-- AB
12UP4B	-- E	17BKP4A	-- P	21CDP4A	-- W	24AWP4	-- AC
12YP4	-- D	17BMP4	-- Q	21CEP4	-- X	24AXP4	-- AC
12ZP4	-- F	17BNP4	-- Q	21CEP4A	-- X	24CP4	-- AA
12ZP4A	-- F	17BRP4	-- S	21CGP4	-- W	24CP4A	-- AA
14ACP4	-- G	17BUP4	-- Q	21CHP4	-- W	24DP4	-- AB
14AEP4	-- G	17BVP4	-- T	21CKP4	-- W	24DP4A	-- AB
14AJP4	-- H	17BWP4	-- T	21CMP4	-- W	24QP4	-- AA
14ARP4	-- G	17BYP4	-- T	21CQP4	-- Y	24TP4	-- AA
14ASP4	-- H	17BZP4	-- S	21CSP4	-- Y	24VP4	-- AA
14ATP4	-- G	17CAP4	-- S	21CUP4	-- V	24VP4A	-- AA
14AUP4	-- G	17CDP4	-- S	21CVP4	-- W	24YP4	-- AB
14AVP4	-- H	17CP4, A	-- R	21CWP4	-- W	24ZP4	-- AB
14AWP4	-- G	17CBP4	-- Q	21CXP4	-- W	27EP4	-- AD
14BP4	-- I	17CKP4	-- S	21CZP4	-- X	27GP4	-- AD
14BP4A	-- I	17CMP4	-- U	21DAP4	-- X	27LP4	-- AE
14CP4	-- J	17CNP4	-- U	21DEP4	-- X	27MP4	-- AD
14CP4A	-- J	17CRP4	-- U	21DEP4A	-- X	27NP4	-- AE
14EP4	-- J	17CSP4	-- T	21DFP4	-- X	27RP4	-- AE
14GP4	-- K	17CTP4	-- S	21DHP4	-- X	27SP4	-- AF
14HP4	-- K	17CUP4	-- U	21DJP4	-- W	27UP4	-- AF
14QP4	-- K	17CVP4	-- S	21DKP4	-- X	27VP4	-- AF

REPLACEMENT GROUP TABLE

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF.
A	9QP4	70	7.4	12 3/4	S	LE	None
A	9QP4A	70	7.48	12 3/4	S	LE	None
B	10ABP4	90	13.2	11 7/8	S	LE	400/850
B	10ABP4A	90	13.2	11 7/8	S	LE	400/850
B	10ABP4B	90	13.2	11 7/8	S	LE	400/850
B	10ABP4C	90	13.2	11 7/8	S	LE	400/850
B	10ADP4	90	13.2	11 7/8	S	LE	400/850
B	10AEP4	90	13.2	11 7/8	S	LE	400/850
C	10BP4	50	11	17 5/8	D	M	500/2500
C	10BP4A	50	11	17 5/8	D	M	500/2500
C	10BP4C	50	11	17 5/8	S	M	500/2500
C	10BP4D	50	11	17 5/8	S	M	500/2500

C	10FP4	50	11	17 5/8	N	M	500/2500
C	10FP4A	50	13.2	17 5/8	N	M	500/2500
D	12LP4	54	13.2	18 3/4	D	M	750/3000
D	12LP4A	54	13.2	18 3/4	D	M	750/3000
D	12LP4C	54	13,2	18 3/4	D	M	750/3000
D	12YP4	54	13.2	18 3/4	S	A	750/3000
E	12QP4	54	13.2	17 1/2	S	M	None
E	12QP4A	54	13.2	17 1/2	S	M	None
E	12RP4	50	13.2	17 1/2	S	M	None
E	12TP4	54	13.2	18 3/4	D	M	None
E	12UP4	54	13.2	18 3/4	S	M	None
E	12UP4A	54	13.2	18 3/4	S	M	None
E	12UP4B	54	13.2	18 3/4	S	M	None
F	12ZP4	54	13.2	17 5/8	S	M	500/2500
F	12ZP4A	54	13.2	17 5/8	S	M	500/2500

Group	Tube Type	Def. Angle in Degrees	Max Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF.
G	14ACP4	90	15.4	14 3/16	S	LE	800/1200
G	14AEP4	90	15.4	13 3/16	N	LE	800/1200
G	14ARP4	90	15.4	13 3/16	N	LE	800/1200
G	14ATP4	90	15.4	13 3/16	N	LE	500/1000
G	14AUP4	90	16.5	13 3/16	N	LE	1000/1500
G	14AW4	90	15.4	13 3/16	N	LE	800/1200
H	14AJP4	110	12.1	11 7/16	S	LE	500/850
H	14ASP4	110	15.4	11 3/8	N	LE	500/850
H	14AVP4	110	15.4	11/38	N	LE	450/700
I	14BP4	70	13.2	16 3/16	S	M	500/2000
I	14BP4A	70	13.2	16 13/16	S	M	500/2000
J	14CP4	70	15.4	16 3/4	S	M	750/2000
J	14CP4A	70	15.4	16 3/4	S	M	750/2000
J	14EP4	70	15.4	16 1/2	S	M	125/1250

K	14GP4	70	15.4	16 13/16	S	HE	750/2000
K	14HP4	70	15.4	16 13/16	S	LE	750/2000
K	14QP4	70	12.1	16 5/32	S	LE	600/1000
K	14QP4A	70	12.1	16 5/32	S	LE	600/1000
L	14RP4	90	15.4	14 3/16	S	LE	800/1200
L	14RP4A	90	15.4	14 3/16	S	LE	800/1200
L	14SP4	90	15.4	14 3/16	S	LE	900/1200
L	14WP4	90	15.4	13 3/16	N	LE	800/1200
L	14ZP4	90	15.4	13 3/16	N	LE	800/1200
M	15CP4	52	16.5	21 1/2	D	M	None
M	15DP4	57	16.5	20 1/2	S	M	None
M	15DP4A	57	16.5	20 1/2	S	M	None
N	16KP4	70	17.6	18 3/4	S	M	750/1500
N	16KP4A	70	17.6	18 3/4	S	M	750/1500
N	16RP4	70	17.6	18 3/4	S	M	750/1500
N	16RP4A	70	17.6	18 3/4	S	M	750/1500

Group	Tube Type	Def. Angle in Degrees	Max Anode Volts in KV	Approx Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF.
O	16SP4	70	15.4	17 5/16	D	M	1500/3500
O	16SP4A	70	15.4	17 5/16	D	M	1500/3500
O	16YP4	70	15.4	17 5/16	S	M	750/2000
P	17AT7P4	90	17.6	15 9/16	S	LE	750/1500
P	17ATP4A	90	17.6	15 9/16	S	LE	750/1500
P	17AVP4	90	17.6	15 5/8	S	LE	1000/1500
P	17AVP4A	90	17.6	15 5/8	S	LE	1000/1500
P	17BJP4	90	17.6	14 5/8	N	LE	1000/1500
P	17BKP4	90	17.6	15 5/8	S	LE	1200/1500
P	17BKP4A	90	17.6	15 5/8	S	LE	1200/1500
Q	17BMP4	90	19.8	15 5/8	S	LE	750/1500
Q	17BNP4	90	19.8	14 5/8	N	LE	750/1500
Q	17BUP4	90	19.8	15 1/4	S	LE	1200/1500
Q	17CBP4	90	19.8	15 1/4	S	LE	1000/1500

R	17BP4	70	17.6	19 1/4	S	M	None
R	17CP4	70	17.6	18 5/8	S	M	None
R	17CP4A	70	17.6	18 5/8	S	M	None
S	17BRP4	110	16.5	12 9/16	S	LE	1000/1500
S	17BZP4	110	17.6	12 9/16	N	LE	1000/1500
S	17CAP4	110	17.6	12 9/16	N	LE	1000/1500
S	17CDP4	110	17.6	12 9/16	N	LE	800/1500
S	17CKP4	110	16.5	12 9/16	S	LE	1000/1500
S	17CTP4	110	17.6	12 9/16	N	LE	1000/1500
S	17CVP4	110	17.6	12 9/16	N	LE	1000/1500
S	17CWP4	110	17.6	11 5/8	N	LE	1000/1500
T	17BVP4	110	17.6	13 1/4	S	LE	1000/1500
T	17BWP4	110	17.6	12 5/16	N	LE	1000/1500
T	17BYP4	110	17.6	12 5/16	N	LE	1000/1500
T	17CSP4	110	17.6	12 5/8	N	LE	900/1400

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF
U	17CMP4	90	17.6	15	N	LE	1200/1500
U	17CNP4	90	17.6	14 5/8	N	LE	1200/1500
U	17CRP4	90	17.6	14 5/8	N	LE	1700/2200
U	17CUP4	90	17.6	15	N	LE	1000/1500
U	17CXP4	90	17.6	14 5/8	N	LE	1000/1500
U	17CYP4	90	17.6	14	N	LE	1000/1500
U	17CZP4	90	17.6	13 5/8	N	LE	1000/1500
U	17DCP4	90	17.6	14 5/8	N	LE	1000/1500
U	17DJP4	90	17.6	15 5/8	S	LE	1000/1500
V	21ACP4	90	22	20	S	M	2000/2500
V	21ACP4A	90	22	20	S	M	2000/2500
V	21AMP4	90	19.8	20	S	M	2000/2500
V	21AMP4A	90	19.8	20	S	M	2000/2500
V	21BSP4	90	22	20	S	M	2000/2500
V	21CUP4	90	22	20	S	M	2000/2500

W	21ALP4	90	19.8	20	S	LE	500/750
W	21A LP4	90	19.8	20	S	LE	500/750
W	21ALP4B	90	22	20	S	LE	500/750
W	21ATP4	90	19.8	20	S	LE	1200/1500
W	21ATP4A	90	22	20	S	LE	1200/1500
W	21BAP4	90	22	20	N	LE	2000/2500
W	21BNP4	90	22	20	N	LE	2000/2500
W	21BTP4	90	22	20	S	LE	2000/2500
W	21CBP4	90	19.8	18	N	LE	2000/2500
W	21CBP4A	90	22	18	N	LE	2000/2500
W	21CBP4B	90	22	18	N	LE	2000/2500
W	21CDP4	90	22	20 3/8	S	LE	2000/2500
W	21CDP4A	90	22	20 3/8	S	LE	2000/2500
W	21CGP4	90	22	20	S	LE	2000/2500
W	21CHP4	90	22	18	N	LE	2000/2500
W	21CKP4	90	22	18	N	LE	2000/2500
W	21CMP4	90	22	19	S	LE	2000/2500

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF
W	21CVP4	90	22	20	N	LE	2000/2500
W	21CWP4	90	22	20	S	LE	2000/2500
W	21CXP4	90	22	18	N	LE	2000/2500
W	21DJP4	90	22	18	N	LE	2000/2500
W	21DLP4	90	22	17	N	LE	2000/2500
W	21DNP4	90	22	19	S	LE	1200/1500
W	21DQP4	90	20	17 1/2	N	LE	2000/2500
W	21DRP4	90	22	18 1/4	N	LE	2000/2500
W	21DSP4	90	22	18	N	LE	2000/2500
W	21DVP4	90	22	20	S	LE	500/750
W	21ELP4	90	22	19	N	LE	2000/2500
W	21ENP4	90	20	19	S	LE	2000/2500
X	21CEP4	110	19.8	14 7/8	N	LE	2000/2500
X	21CEP4A	110	22	14 7/16	N	LE	2000/2500
X	21CZP4	110	19.8	14 11/16	S	LE	2000/2500

X	21DAP4	110	19.8	14 11/16	N	LE	2000/2500
X	21DEP4	110	19.8	14 11/16	N	LE	2000/2500
X	21DEP4A	110	22	14 11/16	N	LE	2000/2500
X	21DFP4	110	19.8	14 7/16	N	LE	1500/2200
X	21DHP4	110	19.8	14 11/16	N	LE	1700/2500
X	21DKP4	110	19.8	14 11/16	N	LE	1700/2500
X	21DMP4	110	22	13 3/4	N	LE	2000/2500
X	21DWP4	110	19.8	14 7/16	N	LE	2000/2500
X	21EMP4	110	19.8	13 3/16	N	LE	2000/2500
Y	21CQP4	110	19.8	14 7/16	N	LE	2000/2500
Y	21CSP4	110	19.8	14 7/16	N	LE	2000/2500
Z	21EQP4	110	20	12 9/16	N	LE	2000/2500
Z	21ERP4	110	20	12 3/16	N	LE	1500/2000

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF
AA	24ADP4	90	24.2	21 1/8	S	M	2000/2500
AA	24CP4	90	22	21 1/8	S	M	2000/2500
AA	24CP4A	90	22	21 1/8	S	M	2000/2500
AA	24QP4	90	19.8	21 1/8	S	M	500/750
AA	24TP4	90	22	21 1/8	S	M	250/2500
AA	24VP4	90	24.2	21 1/8	S	M	2000/2500
AA	24VP4A	90	24.2	21 1/8	S	M	2000/2500
AB	24AEP4	90	22	19 1/8	N	LE	2000/2500
AB	24AJP4	90	22	19 1/8	N	LE	2000/2500
AB	24ANP4	90	22	20 1/8	S	LE	1700/2500
AB	24ASP4	90	22	19 1/8	N	LE	1700/2500
AB	24ATP4	90	22	19 1/8	N	LE	1700/2500
AB	24AUP4	90	22	18 1/8	N	LE	1700/2500
AB	24DP4	90	22	21 1/8	S	LE	2000/2500

AB	24DP4A	90	22	21 1/8	S	LE	2000/2500
AB	24YP4	90	22	21 1/8	S	LE	2000/2500
AB	24ZP4	90	22	21 1/8	N	LE	2000/2500
AC	24AHP4	110	22	15 7/8	N	LE	1700/2500
AC	24ALP4	110	22	15 5/8	N	LE	1700/2500
AC	24AQP4	110	22	15 7/8	N	LE	1700/2500
AC	24AWP4	110	22	14 7/8	N	LE	2000/2500
AC	24AXP4	110	22	15 7/8	N	LE	1700/2500
AD	27EP4	90	22	23 1/16	S	M	None
AD	27GP4	90	24.7	23 1/16	S	M	None
AD	27MP4	90	19.8	21 3/4	S	M	None

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF
AE	27LP4	90	24.2	24 23/64	S	M	250/400
AE	27NP4	90	19.8	23	S	M	2000/2500
AE	27RP4	90	22	23 1/16	S	M	2000/2500
AF	27SP4	90	22	23 1/16	S	LE	500/750
AF	27UP4	90	22	23 1/16	S	LE	500/750
AF	27VP4	90	19.8	21 1/16	N	LE	2000/2500

MEANING OF CODE LETTERS IN ABOVE TABLE

Ion Traps

S - Single Field

D - Double Field

N - No Ion Trap Required

Focusing Methods

HE - High Voltage Electrostatic Focusing

LE - Low Voltage Electrostatic Focusing

A - Automatic (self) Focusing

M - Magnetic Focusing

SECTION 3

TV PICTURE TUBE REPLACEMENT GUIDE
Older Models

Picture tubes are listed in the following INDEX according to type designations, starting with 7AP4 and ending with 30BP4. Wherever substitution is possible, each type number is followed by the number of a SUBSTITUTION GROUP. Tubes in any individual substitution group are interchangeable, some directly with no changes whatsoever, while others require certain changes.

Easy as A, B, C
to Find Tubes Which Are 100% Interchangeable.

Use INDEX B to find the tube to be replaced. This will direct you to the SUBSTITUTION GROUP to which this tube belongs. Next, refer to the KEY column of this group. If tube to be replaced has an "A" in the KEY column, any other tube in this particular group with an "A" in the same column may be used as a substitute without any changes whatsoever. If tube to be replaced has a "B" in the KEY column, it can be replaced without changes, by any tube in the same group with a "B"in that column. Similarly, tubes with "C" are 100% replaceable by other tubes with "C", if in the same substitution group.

In other words, all tubes with the same letter in the KEY column in any particular substitution group are directly interchangeable, since they are identical in all essential features including basing, dimensions, external coating, type of ion trap, etc. This feature makes it as easy as A, B, C to locate a 100% interchangeable picture tube using this guide.

If no letter appears in the KEY COLUMN after any particular tube, this indicates that this tube, while interchangeable with other tubes in its group, will require changes or that it has different dimensions from the other tubes. In many instances, these changes are slight. Their extent can be determined readily by consulting the characteristics given under the other column headings.

The FACE DESCRIPTION column tells whether face of tube is clear, gray, gray frosted, etc. Differences in this column do not affect interchangeability. Treated and frosted screens reduce reflections of external light; aluminized screens give increased brightness, while gray faced tubes improve contrast.

The BASING column designations refer to the basing diagrams which follow Substitution Group 32. These show the socket wiring used with each tube. No changes in the socket wiring are needed in any individual substitution group, with the exception of Group 1. Where two different basing designations are shown with identical socket wiring such as 12L and 12M these are used merely to indicate the absence or presence of external conductive coating.

The DIMENSIONS column permits selection of a suitable substitution tube to fit the cabinet dimensions. Where the neck length of the tube to be replaced is longer than that of the replacement, there may not be sufficient room for best adjustment of the focus coil, yoke and ion trap. It is better to select a replacement tube with the same or slightly shorter neck length.

Presence or absence of EXTERNAL TUBE COATING must be taken into consideration when making picture tube substitutions. When a tube without external coating is used to replace one with this coating, it is necessary to connect a 500 MMF condenser of suitable high voltage rating between anode and chassis. When a tube with external coating is used to replace one without such coating, the external coating must be grounded to the chassis.

The ANODE CONNECTOR column shows whether ball or cavity connector is used. If the replacement tube has a different connector, the change must be made accordingly.

Note from the ION TRAP column that some replacement tubes do not require an ion trap. If a different ion trap is specified for the new tube, this should be installed.

The MAXIMUM ANODE VOLTAGE column gives the rating of each tube. If the set operating voltage is higher than the maximum rating of the tube, it is undesirable to use the tube as a replacement.

When substituting an electrostatic or self-focusing tube for a magnetically focused tube, remove the focus coil from the tube neck and mount it in the cabinet as far from the tube as possible. It should not be disconnected from the circuit unless it is replaced by an equivalent inductance or focus resistance. In substituting an automatic electrostatic focus tube for an electrostatic focus tube, no change in socket wiring is needed and it is unnecessary to remove the focus electrode lead from the socket.

How to Use the TV Picture Tube Guide to Select a Replacement Tube

a. Carefully read the preceding instructions regarding column headings and necessary adjustments.

b. Locate the tube you wish to replace in the following INDEX and find the substitution group for this tube.

c. Pick a tube which is directly interchangeable by consulting the KEY column (tubes with same letters in same group are directly interchangeable). If no tube in the group is directly interchangeable, select the replacement tube which requires the least number of changes. (Different type faces such as bold, italics, regular, indicate need for changes).

d. Note significant differences in neck length and anode voltages, checking with preceding instructions to determine whether substitution is feasible. Make sure tube selected as a replacement will fit cabinet.

EXAMPLE: To Replace a 17AP4 Tube. This tube is in SUBSTITUTION GROUP 18. Since there is no letter in the KEY column, there is no direct replacement. The 17BP4A shown in bold face is identical with the 17AP4 in every respect except in overall length and in neck length. The longer neck length will not affect the substitution. If the 17BP4A is not available, the 17BP4B or 17BP4C may be used as substitutes or the more popular 17JP4 (shown in italics). Its higher anode voltage rating of 18 KV permits it to be used in a set supplying an operating voltage of 16 KV. The most popular tubes are listed in bold faced type. Other popular tubes are shown in italics.

INDEX B

Type Number	Substitution Group
7AP4	None
7CP4	1
7DP4	1
7HP4	2
7NP4	3
7QP4	2
7RP4	None
7TP4	None
7WP4	3
8AP4	4
8AP4A	4
9AP4	None
9CP4	None
10BP4	5
10BP4A	5
10CP4	5
10DP4	None
10EP4	5
10FP4	5
10FP4A	5
10MP4	6
10MP4A	6
10RP4	None
10SP4	None
12AP4	None
12CP4	None
12JP4	7
12KP4	7
12KP4A	7
12LP4	7
12LP4A	7
12QP4	7
12QP4A	7
12RP4	7
12TP4	7
12UP4	8
12UP4A	8
12UP4B	8
12VP4	9
12VP4A	9
12WP4	None
12XP4	None
12YP4	7
14BP4	10
14BP4A	10
14CP4	10
14DP4	10
14EP4	10
14FP4	10
14GP4	None
14HP4	None
14KP4	None
15AP4	11
15CP4	11
15DP4	11
15EP4	None
16ABP4	13-16-21
16ACP4	12
16AEP4	13
16AP4	14
16AP4A	14
16AP4B	14
16CP4	11
16DP4	12
16DP4A	12
16EP4	14
16EP4A	14
16EP4B	14
16FP4	12
16GP4	15
16GP4A	15
16GP4B	15
16GP4C	15
16HP4	12
16HP4A	12
16JP4	12
16JP4A	12
16KP4	16
16KP4A	16
16LP4	11
16LP4A	11
16MP4	12
16MP4A	12
16QP4	16
16RP4	16
16SP4	17
16SP4A	17
16TP4	16
16UP4	16
16VP4	17
16WP4	17
16WP4A	17
16XP4	16
16YP4	17
16ZP4	11
17AP4	18
17BP4	18
17BP4A	18
17BP4B	18
17BP4C	18
17CP4	20
17CP4A	20
17FP4	21
17FP4A	21
17GP4	None
17HP4	13
17HP4A	13
17JP4	18
17KP4	13-18-21
17LP4	22
17LP4A	22
17QP4	19
17RP4	13
17SP4	19-22
17TP4	None
17UP4	19
17VP4	22
17YP4	None
19AP4	23
19AP4A	23
19AP4B	23
19AP4C	23
19AP4D	23
19DP4	24
19DP4A	24
19EP4	25
19FP4	24
19GP4	24
19JP4	25
19QP4	26
20BP4	None
20CP4	25
20CP4A	25
20CP4C	25
20DP4	25
20DP4A	25
20FP4	27
20GP4	27
20HP4	26
20HP4A	26
20HP4B	26
20JP4	25-26-27
20LP4	26
20MP4	26
21AP4	None
21DP4	None
21EP4	28
21EP4A	28
21EP4B	28
21FP4	29
21FP4A	29
21JP4	None
21KP4	28-29
21KP4A	28-29
21MP4	None
21WP4	25
21XP4	26
21XP4A	26
21YP4	26
21ZP4	25
21ZP4A	25
22AP4	30
22AP4A	30
24AP4	31
24AP4A	31
24AP4B	31
24BP4	None
24CP4	None
24DP4	None
27AP4	None
27EP4	32
27GP4	32
27LP4	None
27MP4	None
27NP4	32
27RP4	32
30BP4	None

SUBSTITUTION GROUPS

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				
GROUP 1:	***Glass, spherical, round, electrostatic-focus, 50° to 57° deflection angles.***									
7CP4		Clear	**8BQ**	13 13/16	7 1/8	7 3/8	**No**	**Ball**	**None**	8
7DP4		Clear	12R	14 7/16	7 3/16	8 5/16	Yes	Cavity	Double	8
GROUP 2:	***Glass, spherical, round, magnetic-focus, 50° to 52° deflection angles.***									
7HP4		Clear	12N	13 3/8	7 3/16	7 3/16	Yes	Ball	Double	8.8
7QP4		Clear	12D	13 1/4	7 3/16	7 1/8	**No**	**Cavity**	**Single**	**10**
GROUP 3:	***Glass, spherical, round, projection, magnetic-focus, 35° deflection angle.***									
7NP4		Clear	14N	20 1/8	7 3/16	10 5/8	No	Cap	None	80
7WP4		Clear	14N	20 1/16	7 3/16	10 5/8	**Yes**	Cap	None	80
GROUP 4:	***Metal, spherical, round, magnetic-focus, 54° deflection angle.***									
8AP4	A	Clear	12H	14 5/8	8 11/16	7 3/16	—	Cone Lip	Single	9
8AP4A	A	Gray	12H	14 5/8	8 11/16	7 3/16	—	Cone Lip	Single	9

GROUP 5: ***Glass, spherical, round, magnetic-focus, 50° to 54° deflection angles.***

10BP4	A	Clear	12N	18	10⅝	8⅜	Yes	Cavity	Double	10
10BP4A	A	Gray	12N	18	10⅝	8⅜	Yes	Cavity	Double	10
10CP4		Clear	12N	17	10⅝	7⅞	Yes	**Ball**	Double	**12**
10EP4		Clear	12N	18	10⅝	8⅜	Yes	**Ball**	Double	**12**
10FP4	B	Clear, Alum.	12N	18	10⅝	8⅜	Yes	Cavity	**None**	**12**
10FP4A	B	Gray, Alum.	12N	18	10⅝	8⅜	Yes	Cavity	**None**	**12**

GROUP 6: ***Glass, spherical, round, magnetic-focus, 52° deflection angle.***

10MP4	A	Clear	12G	17⅜	10⅝	7¾	Yes	Cavity	Double	10
10MP4A	A	Gray	12G	17⅜	10⅝	7¾	Yes	Cavity	Double	10

GROUP 7: ***Glass, spherical, round, magnetic-focus (unless otherwise indicated), 50° to 56° deflection angles.***

12JP4		Clear	12D	18	12⅜†	7¼	**No**	**Ball**	*None*	12
12KP4	A	Clear, Alum.	12N	18	12⅝	7⅝	Yes	Cavity	*None*	12
12KP4A	A	Gray, Alum.	12N	18	12⅝	7⅝	Yes	Cavity	*None*	12
12LP4	B	Clear	12N	19⅛	12½	8⅛	Yes	Cavity	Double	12
12LP4A	B	Gray	12N	19⅛	12½	8⅛	Yes	Cavity	Double	12
12QP4	C	Clear	12D	17⅞	12⅝	7⅜	**No**	**Ball**	**Single**	12
12QP4A	C	Gray	12D	17⅞	12⅝	7⅜	**No**	**Ball**	**Single**	12
12RP4		Clear	12D	18	12⅜†	7¼	**No**	**Ball**	**Single**	12
12TP4		Clear	12D	19⅛	12½	8⅛	**No**	Cavity	Double	12
12YP4*		Clear	12N	19⅛	12½	8⅛	Yes	Cavity	**Single**	12

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				
GROUP 8: ***Metal, spherical, round, magnetic-focus, 54° deflection angle.***										
12UP4	A	Clear	12D	19	12½	8 1/16	—	Cone Lip	**Double**	12
12UP4A	A	Gray	12D	19	12½	8 1/16	—	Cone Lip	**Double**	12
12UP4B		Gray, Treated	12D	19	12½	8 1/16	—	Cone Lip	Single	12
GROUP 9: ***Glass, spherical, round, magnetic-focus, 55° deflection angle.***										
12VP4	A	Clear	12G	18 3/8	12½	7 11/16	Yes	Cavity	Double	12
12VP4A	A	Gray	12G	18 3/8	12½	7 11/16	Yes	Cavity	Double	12
GROUP 10: ***Glass, spherical, rectangular, magnetic-focus, 65° deflection angle.***										
14BP4	A	Gray	12N	17 3/16	9 13/16 x 12 5/8	7 23/32	Yes	Cavity	Single	14
14BP4A	A	Gray, Treated	12N	17 3/16	9 13/16 x 12 5/8	7 23/32	Yes	Cavity	Single	14
14CP4	A	Gray	12N	17 1/8	9 27/32 x 12 21/32	7 21/32	Yes	Cavity	Single	14
14DP4		Gray	12D	17 1/8	9 27/32 x 12 21/32	7 21/32	**No**	Cavity	**Double**	14
14EP4		Gray	12N	16 17/32	9 27/32 x 12 21/32	7 1/16	Yes	Cavity	Single	14
14FP4		Gray	12D	16½	9 27/32 x 12 21/32	7 1/16	**No**	Cavity	Single	14
GROUP 11: ***Glass, spherical, round, magnetic-focus, 50° to 57° deflection angles.***										
15AP4		Clear	12D	20 7/8	15 3/4	7 1/8	**No**	**Ball**	*None*	**15**
15CP4		Clear	12D	21 7/8	15 3/4	8 3/16	**No**	Cavity	Double	**15**
15DP4		Clear	12D	20 7/8	15 3/4	7 1/8	**No**	**Ball**	**Single**	**15**
16CP4		Clear	12D	21 7/8	15 15/16	6 13/16	**No**	Cavity	Double	**15**
16LP4	A	Clear	12N	22 5/8	16	7 5/16	Yes	Cavity	Double	14
16LP4A	A	Gray	12N	22 5/8	16	7 5/16	Yes	Cavity	Double	14
16ZP4		Gray	12N	22 5/8	16	7 5/16	Yes	Cavity	Double	*16*

GROUP 12: ***Glass, spherical, round, magnetic-focus (unless otherwise indicated), 60° to 62° deflection angles.***

16ACP4*		Clear	12N	21⅛	16	8¼	Yes	Cavity	**Single**	14
16DP4		Clear	12D	21	16	8 5/16	**No**	Cavity	Double	**15**
16DP4A		Gray	12D	21	16	7 15/16	**No**	Cavity	Double	**15**
16FP4		Clear	12D	20⅝	16⅜	7⅜	**No**	**Ball**	**Single**	*16*
16HP4	A	Clear	12N	21⅝	16	8 9/16	Yes	Cavity	Double	14
16HP4A	A	Gray	12N	21⅝	16	8 9/16	Yes	Cavity	Double	14
16JP4	B	Clear	12N	21⅛	16⅜	7 11/16	Yes	Cavity	Double	14
16JP4A	B	Gray	12N	21⅛	16⅜	7 11/16	Yes	Cavity	Double	14
16MP4	C	Clear	12N	22⅛	16⅜	8 11/16	Yes	Cavity	Double	14
16MP4A	C	Gray	12N	22⅛	16⅜	8 11/16	Yes	Cavity	Double	14

GROUP 13: ***Glass, spherical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65° deflection angle.***

16ABP4*		Gray	12N	19⅛	11⅝x14⅞	7 11/16	Yes	Cavity	Single	16
16AEP4		Gray	12L	19⅛	11⅝x14⅞	7 11/16	Yes	Cavity	Single	16
17HP4	A	Gray	12L	19 9/16	12⅜x15½	7 11/16	Yes	Cavity	Single	16
17HP4A	A	Gray, Treated	12L	19 9/16	12⅜x15½	7 11/16	Yes	Cavity	Single	16
17KP4*		Gray	12P	19⅝	12⅜x15½	7 11/16	Yes	Cavity	Single	16
17RP4	A	Gray	12L	19⅝	12⅜x15½	7 11/16	Yes	Cavity	Single	16

GROUP 14: ***Metal, spherical, round, magnetic-focus, 53° to 60° deflection angles.***

16AP4	A	Clear	12D	22⅝	16	7⅝	—	Cone Lip	Double	14
16AP4A	A	Gray	12D	22⅝	16	7⅝	—	Cone Lip	Double	14
16AP4B	A	Gray, Frosted	12D	22⅝	16	7⅝	—	Cone Lip	Double	14
16EP4	B	Clear	12D	20	16	6 15/16	—	Cone Lip	Double	14
16EP4A	B	Gray	12D	20	16	6 15/16	—	Cone Lip	Double	14
16EP4B		Gray, Treated	12D	20	16	6 15/16	—	Cone Lip	**Single**	14

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				
GROUP 15: ***Metal, spherical, round, magnetic-focus, 70° deflection angle.***										
16GP4	A	Gray	12D	17 11/16	16	7	—	Cone Lip	Single	14
16GP4A	A	Clear	12D	17 11/16	16	7	—	Cone Lip	Single	14
16GP4B	A	Gray, Frosted	12D	17 11/16	16	7	—	Cone Lip	Single	14
16GP4C	A	Clear, Frosted	12D	17 11/16	16	7	—	Cone Lip	Single	14
GROUP 16: ***Glass, spherical, rectangular, magnetic-focus (unless otherwise indicated), 65° deflection angle.***										
16ABP4*		Gray	12N	19 1/8	11 5/8x14 7/8	7 11/16	Yes	Cavity	Single	16
16KP4	A	Gray	12N	19 1/8	11 5/8x14 7/8	7 11/16	Yes	Cavity	Single	16
16KP4A	A	Gray, Alum.	12N	19 1/8	11 5/8x14 7/8	7 11/16	Yes	Cavity	Single	16
16QP4		Gray	12D	19 1/8	11 5/8x14 7/8	8 1/16	**No**	Cavity	**Double**	16
16RP4	A	Gray	12N	19 1/8	11 5/8x14 7/8	7 11/16	Yes	Cavity	Single	16
16TP4		Gray	12N	18 1/2	11 5/8x14 7/8	7 1/16	Yes	Cavity	Single	*14*
16UP4		Gray	12D	18 5/8	11 5/8x14 7/8	7 1/8	**No**	Cavity	Single	**15**
16XP4		Gray	12D	19 1/8	11 5/8x14 7/8	7 11/16	**No**	Cavity	**Double**	**15**
GROUP 17: ***Glass, spherical, round, magnetic-focus, 70° deflection angle.***										
16SP4	A	Clear	12N	17 11/16	16	7 3/16	**Yes**	Cavity	Double	**14**
16SP4A	A	Gray	12N	17 11/16	16	7 3/16	**Yes**	Cavity	Double	**14**
16VP4		Gray	12D	17 7/16	16	7 1/16	No	Cavity	**Single**	15
16WP4		Gray	12D	18 1/8	16	7 5/8	No	Cavity	Double	15
16WP4A		Gray	12N	18 1/8	16	7 5/8	**Yes**	Cavity	Double	*16*
16YP4		Gray	12N	17 11/16	16	7 3/16	**Yes**	Cavity	**Single**	**14**

GROUP 18: ***Glass, spherical, rectangular, magnetic-focus (unless otherwise indicated), 65° deflection angle.***

17AP4		Gray	12N	19	12⅜x15½	7⅛	Yes	Cavity	Single	16
17BP4		Gray	12D	19⅝	12⅜x15½	7⅛	**No**	Cavity	Single	16
17BP4A	A	Gray	12N	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	16
17BP4B	A	Gray, Alum.	12N	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	16
17BP4C	A	Gray, Treated	12N	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	16
17JP4		Gray	12N	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	**18**
17KP4*		Gray	12P	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	16

GROUP 19: ***Glass, cylindrical, rectangular, magnetic-focus (unless otherwise indicated), 65° to 70° deflection angles.***

17QP4		Gray	12N	19⅞	12⅜x15½	7⅛	Yes	Cavity	Single	16
17SP4*		Gray	12N	19⅞	12⅜x15½	7⅛	Yes	Cavity	Single	**14**
17UP4		Gray	12N	19⅞	12⅜x15½	7⅛	Yes	Cavity	Single	**14**

GROUP 20: ***Metal, spherical, rectangular, magnetic-focus, 66° deflection angle.***

17CP4	A	Gray, Frosted	12D	19	12⅜x16⅛	7⅜	—	Cone Lip	Single	16
17CP4A	A	Gray	12D	19	12⅜x16⅛	7⅜	—	Cone Lip	Single	16

GROUP 21: ***Glass, spherical, rectangular, high-voltage electrostatic-focus (unless otherwise indicated), 65° deflection angle.***

16ABP4*		Gray	12N	19⅛	11⅝x14⅞	7⅛	Yes	Cavity	Single	**16**
17FP4	A	Gray	12L	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	18
17FP4A	A	Gray	12L	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	18
17KP4*		Gray	12P	19⅝	12⅜x15½	7⅛	Yes	Cavity	Single	**16**

GROUP 22: ***Glass, cylindrical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65° to 66° deflection angles.***

17LP4	A	Gray	12L	19⅞	12⅜x15½	7⅛	Yes	Cavity	Single	16
17LP4A	A	Gray	12L	19⅞	12⅜x15½	7⅛	Yes	Cavity	Single	16
17SP4*		Gray	12N	19⅞	12⅜x15½	7⅛	Yes	Cavity	Single	**14**
17VP4	A	Gray	12L	19⅞	12⅜x15½	7⅛	Yes	Cavity	Single	16

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches: Over-all Length	Diameter or Height x Width	Neck Length	External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
GROUP 23: ***Metal, spherical, round, magnetic-focus, 66° deflection angle.***										
19AP4	A	Clear	12D	22	18¾	7⅜	—	Cone Lip	Single	19
19AP4A	A	Gray	12D	22	18¾	7⅜	—	Cone Lip	Single	19
19AP4B	A	Gray, Frosted	12D	22	18¾	7⅜	—	Cone Lip	Single	19
19AP4C	A	Gray, Alum.	12D	22	18¾	7⅜	—	Cone Lip	Single	19
19AP4D	A	Clear, Frosted	12D	22	18¾	7⅜	—	Cone Lip	Single	19
GROUP 24: ***Glass, spherical, round, magnetic-focus, 66° deflection angle.***										
19DP4	A	Clear	12N	21⅛	19	7⅝	**Yes**	Cavity	Double	**17**
19DP4A	A	Gray	12N	21⅛	19	7⅝	**Yes**	Cavity	Double	**17**
19FP4		Gray	12D	22½	19	7⅞	No	Cavity	Double	19
19GP4		Gray	12D	21⅞	19	7⅛	No	Cavity	**Single**	19
GROUP 25: ***Glass, spherical, rectangular, magnetic-focus (unless otherwise indicated), 65° to 66° deflection angles.***										
19EP4		Gray	12D	21½	13$\frac{3}{32}$x17⅛	7$\frac{11}{16}$	**No**	Cavity	Single	**19**
19JP4		Gray	12D	21⅜	13$\frac{5}{16}$x17$\frac{3}{16}$	7⅜	**No**	Cavity	Single	18
20CP4	A	Gray	12D	21$\frac{13}{16}$	15⅛x18⅞	7⅜	**No**	Cavity	Single	18
20CP4A		Gray	12N	21$\frac{13}{16}$	15⅛x18⅞	7⅜	Yes	Cavity	Single	18
20CP4C	A	Gray, Treated	12D	21$\frac{13}{16}$	15⅛x18⅞	7⅜	**No**	Cavity	Single	18
20DP4		Gray	12D	22⅛	15⅛x18⅞	7$\frac{11}{16}$	**No**	Cavity	Single	18
20DP4A		Gray	12N	22⅛	15⅛x18⅞	7$\frac{11}{16}$	Yes	Cavity	Single	18
20JP4*		Gray	12P	22⅛	15⅛x18⅞	7$\frac{11}{16}$	Yes	Cavity	Single	18
21WP4		Gray	12N	22⅝	15⅛x18⅞	7$\frac{11}{16}$	Yes	Cavity	Single	18
21ZP4		Gray	12D	23$\frac{3}{32}$	15¾x20$\frac{7}{16}$	7$\frac{11}{16}$	**No**	Cavity	Single	18
21ZP4A		Gray	12N	23⅜	15¾x20$\frac{7}{16}$	7$\frac{11}{16}$	Yes	Cavity	Single	18

GROUP 26: ***Glass, spherical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65° to 66° deflection angles.***

19QP4		Gray	12L	21½	13⅝x17⅜	7 11/16	Yes	Cavity	Single	**18**
20HP4	A	Gray	12M	22⅛	15⅛x18⅞	7 11/16	**No**	Cavity	Single	16
20HP4A	B	Gray	12L	22⅛	15⅛x18⅞	7 11/16	Yes	Cavity	Single	16
20HP4B	A	Gray, Treated	12M	22⅛	15⅛x18⅞	7 11/16	**No**	Cavity	Single	16
20JP4*		Gray	12P	22⅛	15⅛x18⅞	7 11/16	Yes	Cavity	Single	**18**
20LP4	B	Gray	12L	22⅛	15⅛x18⅞	7 11/16	Yes	Cavity	Single	16
20MP4	B	Gray	12L	22⅛	15⅛x18⅞	7 11/16	Yes	Cavity	Single	16
21XP4	C	Gray	12L	22⅝	15⅛x18⅞	7 11/16	Yes	Cavity	Single	**18**
21XP4A	C	Gray	12L	22⅝	15⅛x18⅞	7 11/16	Yes	Cavity	Single	**18**
21YP4		Gray	12L	23⅜	15¾x20 7/16	7 11/16	Yes	Cavity	Single	**18**

GROUP 27: ***Glass, spherical, rectangular, high-voltage electrostatic-focus (unless otherwise indicated), 65° to 66° deflection angles.***

20FP4		Gray	12M	22⅛	15⅛x18⅞	7 11/16	No	Cavity	Single	18
20GP4		Gray	12L	22⅛	15⅛x18⅞	7 11/16	**Yes**	Cavity	Single	18
20JP4*		Gray	12P	22⅛	15⅛x18⅞	7 11/16	**Yes**	Cavity	Single	18

GROUP 28: ***Glass, cylindrical, rectangular, magnetic-focus (unless otherwise indicated), 65° to 70° deflection angles.***

21EP4		Gray	12D	23⅜	15¾ x20 7/16	7 11/16	**No**	Cavity	Single	18
21EP4A	A	Gray	12N	23⅜	15¾ x20 7/16	7 11/16	Yes	Cavity	Single	18
21EP4B	A	Gray, Alum.	12N	23⅜	15¾ x20 7/16	7 11/16	Yes	Cavity	Single	18
21KP4*		Gray	12D	23¼	15 11/16x20⅜	7 11/16	**No**	Cavity	Single	18
21KP4A*		Gray	12P	23⅜	15 11/16x20⅜	7 11/16	Yes	Cavity	Single	18

GROUP 29: ***Glass, cylindrical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65° to 70° deflection angles.***

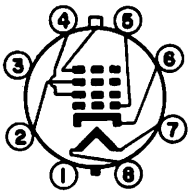
21FP4		Gray	12M	22⅜	15¾ x20 7/16	7 11/16	**No**	Cavity	Single	18
21FP4A		Gray	12L	22⅜	15¾ x20 7/16	7 11/16	Yes	Cavity	Single	18
21KP4*		Gray	12D	23¼	15 11/16x20⅜	7 11/16	**No**	Cavity	Single	18
21KP4A*		Gray	12P	23⅜	15 11/16x20⅜	7 11/16	Yes	Cavity	Single	18

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				
GROUP 30: ***Metal, spherical, round, magnetic-focus, 70° deflection angle.***										
22AP4	A	Clear	12D	23⅜	21 13/16	7⅝	—	Cone Lip	Single	19
22AP4A	A	Gray	12D	23⅜	21 13/16	7⅝	—	Cone Lip	Single	19
GROUP 31: ***Metal, spherical, round, magnetic-focus, 70° deflection angle.***										
24AP4	A	Gray	12D	24 3/16	24⅛	7 11/32	—	Cone Lip	Single	16
24AP4A	A	Gray, Alum.	12D	24 3/16	24⅛	7 11/32	—	Cone Lip	Single	16
24AP4B	A	Gray, Treated	12D	24 3/16	24⅛	7 11/32	—	Cone Lip	Single	16
GROUP 32: ***Glass, spherical, rectangular, magnetic-focus, 85° to 90° deflection angles.***										
27EP4		Gray, Alum.	12D	23 3/16	20 13/32 x 25 13/32	7 11/16	No	Cavity	Single	20
27GP4		Gray	12D	23 3/16	20 9/32 x 25 11/32	7 11/16	No	Cavity	Single	*22.5*
27NP4		Gray	12N	23⅜	20 11/32 x 25 13/32	7 11/16	**Yes**	Cavity	Single	**18**
27RP4		Gray, Alum.	12N	23 3/16	20 13/32 x 25 13/32	7 11/16	**Yes**	Cavity	Single	20

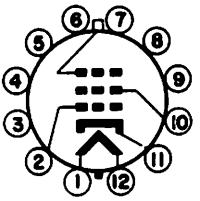
* Tube has automatic electrostatic-focus. This tube may be used as a substitute only. Replace it with other automatic electrostatic-focus tubes of the same Substitution Group.

† This tube has a face-plate radius of curvature of 20 inches. Dimension A (see Outline Drawings) of this tube is approximately half an inch larger than that of other tubes in this group. Inspect the particular mask to determine if this additional half inch can be accommodated.

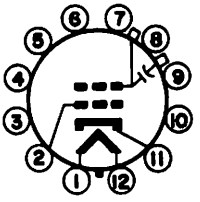
Outline and Basing Diagrams



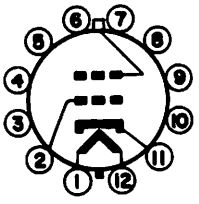
8BQ



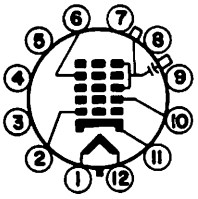
12D



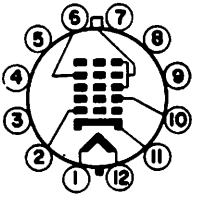
12G



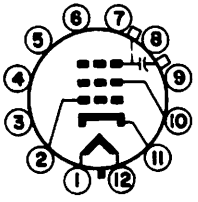
12H



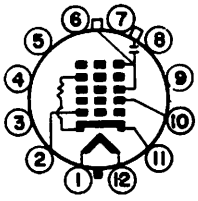
12L



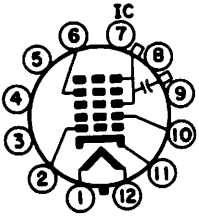
12M



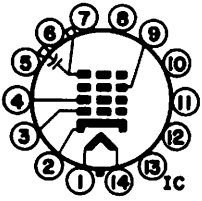
12N



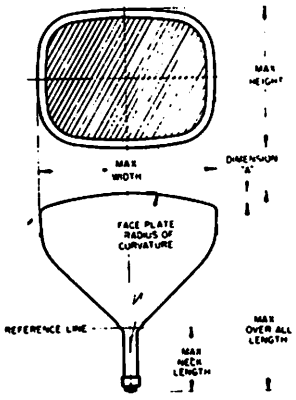
12P



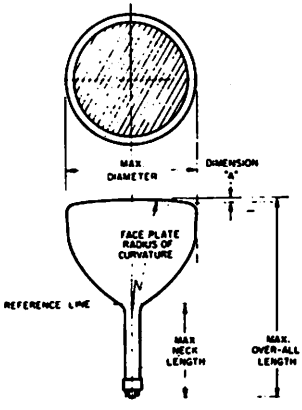
12R



14N



RECTANGULAR PICTURE TUBE



ROUND PICTURE TUBE

SECTION 4

U.S.A. SUBSTITUTES FOR FOREIGN TUBES

NOTE: Certain tube types in the list below may be substituted only in parallel connected circuits. These are indicated by an asterisk (*) after the tube designation. Some substitutes are European, now sold in U. S. A.

Tube	Substitute
B36	12SN7
B65	6SN7
B152	12AT7
B309	12AT7
B329	12AU7
B339	12AX7
BPM04	6AQ5
D63	6H6
D77	6AL5
D152	6AL5
DA90	1A3
DAC32	1H5
DAF91	1S5
DAF92	1U5
DAF96	1AH5
DC70	6375
DC80	1E3
DCC90	3A5
DD6	6AL5
DD7	6AL5
DF33	1N5
DF62	1AD4
DF91	1T4
DF92	1L4
DF96	1AF4, 1AJ4
DF703	CK5886
DF904	1U4
DH63(M)	6Q7, 6Q7GT
DH77	6AT6
DH149	7C6
DK32	1A7
DK91	1R5
DK92	1AC6
DK96	1AB6
DL33	3Q5
DL35	1C5
DL36	1Q5
DL91	1S4
DL92	3S4
DL93	3A4
DL94	3V4
DL95	3Q4
DL96	3C4
DL651	CK546
DM70	1M3
DP61	6AK5
DY80	1X2A, 1X2B
DY86	1S2, 1S2A, 1H2
E90CC	5920
E180F	6688
EA76	6489
EAA91	6AL5
EAA9015	5726
EABC80	6AK8, 6T8, 6R8
EB34	6H6*
EB91	6AL5
EBC33	1639
EBC90	6AT6
EBC91	6AV6
EBF80	6N8
EBF86	6267
EC81	6R4
EC90	6C4
EC91	6AQ4
EC90	6AB4
ECC33	6SN7*

Tube	Substitute
ECC35	6SL7*
ECC40	6N7*
ECC81	12AT7
ECC82	12AU7
ECC83	12AX7
ECC84	6BQ7A*
ECC85	6AQ8
ECC91	6J6
ECC801S	6201
ECF82	6U8
ECH81	6AJ8
ECL80	6AB8
ECL82	6BM8
EF80	6BX6
EF85	6BY7
EF86	6DA6
EF89	6DA6
EF91	6AM6
EF92	6CQ6
EF93	6BA6
EF94	6AU6
EF95	6AK5
EF96	6AG5
EH90	6CS6
EH900	5915
EK90	6BE6
EL33	6M6G
EL34	6CA7
EL37	6L6
EL38	6CN6
EL81	6CJ6
EL83	6CK6
EL84	6BQ5
EL85	6BN5
EL86	6CW5
EL90	6AQ5
EL91	6AM5
EL803	6CK6
EL821	6CH6
EM34	6CD7
EM35	6U5G
EM80	6BR5
EQ80	6BE7
EY51	6X2
EY80	6U3
EY86	6S2
EZ35	6X5/GT
EZ80	6V4
EZ81	6BW4*, 6AC4*
EZ90	6X4
GZ30	5Z4
GZ32	5V4
GZ34	5U4, 5AR4
H52	5U4
H63	6F5
HABC80	19T8
HBC90	12AT6
HBC91	12AV6
HCH42	14K7
HD14	1H5
HD30	3B4
HF93	12BA6
HF94	12AU6
HK90	12BE6
HL90	19AQ5
HL92	50 C5
HM04	6BE6
HY90	35W4
KF35	1E5
KK32	1C5
KL35	1F5
KT32	25L6
KT63	6J7
KT66	6L6*
KT81	7C5
KTW63	6K7
L63	6J5
L77	6C4
LN152	6AB8
LZ319	8A8, 9A8
ME 1401	-,5802
MT5545	5545
MW36-24	14EP4*
MW43-61	17QP4*

Tube	Substitute
N14	1C5
N17	3S4
N18	3Q4
N19	3V4
N77	6AM5
N78	6BJ5
N144	6AN5
N147	6AG6
N148	7C5
N152	21A6
N329	16A5
N709	6BQ5
N727	6AQ5
PABC80	9AK8
PCC84	7AN7
PCC85	9AQ8
PCF80	8A8, 9A8
PCF82	9U8
PCL82	16A8
PL21	5727
PL36	25E5
PL81	21A6
PL82	16A5
PL83	15A6
PM04	6BA6
PM05	6AK5
PM07	6AM6
PY81	17Z3
PY82	19X3, 19Y3
QQV03-10	6360
QQV03-20A	6252
QQV03-28	6252
SP6	6AM6
STV85/10	0G3
STV108/30	0B2
STV150/30	0A2
U41	1B3
U50	5Y3
U52	5U4
U70	6X5
U78	6X4
U147	6X5
U154	19Y3
U319	19Y3
UBC41	14L7
UCH42	14K7
UF41	12AC5
W17	1T4
W63	6K7
W77	6065
W179	6BY7
X14	1A7
X17	1R5
X18	1AC6
X63	6A8
X79	6AE8
Y61	6U5
Y63	6U5
Z14	1N5
Z63	6J7
Z77	6AM6
Z152	6BX6
Z719	6BX6
ZD17	1S5
1C1	1R5
1C2	1AC6
1D13	1A3
1F2	1L4
1F3	1T4
1FD9	1S5
1P10	3S4
1P11	3V4
2D21	5727
6D2	6AL5
6F12	6AM6
6M1	6U5G
7D9	6AM5
8D3	6AM6
30C1	8A8
30L1	7AN7
63ME	6U5G
64ME	6CD7
85A1	0E3
85A2	0G3
5881	6L6

SECTION 5

TRANSISTOR REPLACEMENT DATA

2N34 - 2N131, 2N185, L5021, L5021L
2N44 - 2N63
2N63 - 2N44
2N104 - 2N132, 2N215, R35, 310, L5022
2N107 - CK722
2N109 - 2N138A
2N111 - 235, 2N135
2N111A - 2N139, 2N218

2N112 - 2N136, 2N140, 2N219, GT760
2N113 - GT761, 2N137
2N130 - 2T12
2N131 - 2N34, 2N185, L5021, L5021L, 2N185
2N132 - 2N104, 2N215, R35, 310, L5022
2N133 - 2N175, 2N220
2N135 - 2N111, 235
2N136 - 2N112, 2N140, 2N219, GT760
2N137 - 2N113, GT761
2N138 - 2N189, 354, L5028
2N138A - 2N217, 353
2N139 - 2N111A, 2N139, 2N218
2N140 - 2N112, 2N136, 2N140, 2N219, GT760
2N175 - 2N133, 2N220
2N185 - 2N131, 2N34, L5021, L5021L
2N189 - 2N138, 354, L5028
2N215 - 2N132, 2N104, R35, 310, L5022
2N217 - 2N138A, 353
2N218 - 2N111A, 2N139
2N219 - 2N112, 2N136, 2N140, 2N219, GT760
2N220 - 2N133. 2N175
2T12 - 2N130
235 - 2N111, 2N135
310 - 2N132, 2N104, 2N215, R35, L5022
353 - 2N138A, 2N217
354 - 2N138, 2N189, L5028
GT760 - 2N112, 2N136, 2N140, 2N219
GT761 - 2N113, 2N137
L5021 - 2N131, L5021L, 2N34, 2N185
L5021L - 2N131, L5021L, 2N34, 2N185
L5022 - 2N132, 2N104, 2N215, R35, 310
L5028 - 2N138, 2N189, 354
R35 - 2N132, L5022, 2N104 2N215, 310

Raytheon Subminiature Transistors

TYPE	EQUIVALENT	USE	TYPE	EQUIVALENT	USE
CK4	2N404	COMPUTER	CK81	2N481	IF and RF
CK25	2N425		CK82	2N482	RADIO
CK26	2N426		CK83	2N483	RECEIVER
CK27	2N427		CK84	2N484	
CK28	2N428		CK85	2N485	
CK22	2N422	GENERAL	CK86	2N486	
CK64	2N464	PURPOSE	CK87	2N487	
CK65	2N465	AUDIO	CK13	2N413	GENERAL
CK66	2N466		CK14	2N414	PURPOSE
CK67	2N467		CK16	2N416	RADIO
CK34	CK754		CK17	2N417	FREQUENCY

REPLACEMENT TRANSISTORS
For Popular Transistor Radio Sets

MANUFACTURER & MODEL	V BATT	CONVERTER	IF	IF	DET.	AF	POWER	
Bulova 270C	9V	CK766 GE 2N136	2N112A 2N135	— —	1N295 1N64	2N132 2N192	2N138A 2N241A	
Bulova 270/277	9V	2N112 GE 2N136	2N112 2N135	— —	CK706A 1N64	2N132 2N192	2N138 (2) 2N192 (2)	
CBS TR 250	21V/12V	GE 2N136	2N135	2N135	4JD1A26	—	2N44	
CBS TR 260	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N60 1N64	310 2N192	2N189 (2) 2N189 (2)	Note 2 Note 1
Dewald K 701 & 702 Dewald	9V	2N112 GE 2N136	2N112 2N135	2N112 2N135	1N295 1N64	2N109 2N192	2N109 (2) 2N188 (2)	
Dumont 1210	9V	2N168A GE 2N168A	2N168 2N293	2N168 2N293	Diode 1N64	CK882 2N192	CK888 (2) 2N188 (2)	Note 3
Emerson 842	4V	830 GE 2N169	2N146 2N169	2N146 2N169	Diode 1N64	310 2N192	353 (2) 2N188 (2)	Note 2 Note 1
Emerson 855	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N195 1N64	2N109 2N192	2N109 (2) 2N188 (2)	Note 2
GE 675 Ebony, 676 Ivory 677 Red, 678 Aqua	13½ 13½	Early Prod 2N136 Late Prod 2N135	2N137 2N135	2N135 2N135	2N78 1N87	— 2N169	2N44 2N44	Note 4 Note 5
GE P715 Beige, P716 Black	3V	GE 2N168A	2N169	2N169	1N87	2N192	2N241 (2)	
GE P720 Ginger, P721 Champagne	6V	GE 2N168A	2N293	2N169	1N87	2N191	2N188A (2)	
Hallicrafters TR 88 El Diablo	6V	2N112 GE 2N136	2N112 or 2N135	2N139 2N135	None None	2N109 or 310 2N192	2N109 (2) or 352 (2) 2N188 (2)	
Magnavox AM2 Companion (CR 729 AA)	4V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N295 1N64	310 2N192	353 (2) 2N188 (2)	Note 2 Note 1
Motorola 56 T1	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	R35 2N191	— —	354 2N188	Note 2 Note 1

Motorola 6 x 31	6V	GE 2N168A	2N293	2N292	Diode	2N189 or 2N190	2N186 or 2N187	
Motorola 6 x 32	12V	GE 2N293	2N168A	2N169	Diode	2N191 or 2N192	2N188 or 2N241	
RCA 7BT-9J	9V	235 GE 2N168A	234 2N169	234 2N169	1N295 1N64	2N109 2N192	2N109 (2) 2N188 (2)	
Raytheon 8 T P 1		CK760 CK759 GE 2N136 2H135	CK760 2N135	CK760 2N135	CK721 2N191	CK721 2N191	CK721 (2) 2N188 (2)	Oscillator
Raytheon FM101A	6V	2N113/14 2N112/13 GE 2N136 2N135	2N112 2N135	2N112 2N135	2N112 2N135	CK721/22 2N191	CK721/22 (2) 2N188	Oscillator
Raytheon T—100 Series		2N112/13 GE 2N136	2N112 2N135	2N112 2N135	Diode 1N64	2N132 2N192	2N138 2N192	
Regency TRL	22½	223 GE 2N169	222 2N169	222 2N169	1N69 1N64	— —	210 2N169A	Note 1
Sentinel 369P	4V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N295 1N64	310 2N192	353 (2) 2N188 (2)	Note 2 Note 1
Sonic TR 700 Capri	9V	GE 2N168A GE 2N168A	2N168 2N293	2N169A 2N169	1N64 1N64	2N191 2N190	2N188A (2) 2N187 (2)	Note 3
Traveler	13½	GE 2N136	2N135	2N135	4JD1A26	—	2N187A	
Westinghouse 7	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	880 2N169	310 2N192	2N185 (2) 2N188A (2)	Note 2
Zenith 500	6V	2N94 GE 2N169	2N94 2N169A	2N94 2N169A	1N295 1N64	2N35 2N169A	2N35 (2) 2N169A	Note 1
Zenith 800	12V	GE 2N168A	2N168	2N169A	1N295	2N190	2N188A (2)	Note 3

*This list includes transistor production radios for which information is currently available. It is primarily for information and is intended only as a general guide for replacements.

The radio battery should be replaced with a fresh unit before checking transistors. If necessary to replace transistors, some selection may be necessary in order to obtain optimum performance since transistors of various manufacturers are made by slightly different processes and are not precisely interchangeable.

NOTES:

1. Remove any neutralization loops around IF circuits before operating with GE NPN transistors.
2. In some radios where the 2N146 is shown in both IF stages, one 2N145 and one 2N147 may be found instead in these stages.
3. The 2N293 may be used to replace the 2N168 in IF stages.
4. The 2N169 may be used to replace the 2N78 in AF stages.
5. The 2N186A may be used to replace the 2N44 in AF output stages.

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